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ABSTRACT

This document, third in a series of 11 subvolumes of a handbook prepared to provide training for educational research and development personnel in the development of instructional materials, deals with the task of sequencing and grouping criterion behaviors. Document content is arranged according to the steps involved in performing the task. This task includes three steps: (a) sequence task analysis results for all the subcriterion behaviors that make up each criterion behavior; (b) sequence task analysis results for all criterion behaviors that make up an instructional program; and (c) create instructional units. More specific substeps are included for performing the three steps. Background information includes a matrix presentation of the purposes of sequencing and the concerns of sequencing decisions. (PD)

AIR-20241-9/71-RP

A Technology For Developing Instructional Materials

3 HANDBOOK

ED 092506

A. PLAN STUDY OF CRITERION BEHAVIORS

B. COLLECT AND ANALYZE DATA ABOUT CRITERION BEHAVIORS

C. SEQUENCE AND GROUP CRITERION BEHAVIORS

D. STATE CRITERION AND PREPARATORY OBJECTIVES

E. PLAN SIMULATION BASED ON INSTRUCTIONAL AND LOGISTICAL NEEDS

F. DEVELOP DIAGNOSTIC AND EVALUATIVE TESTS

G. FORMULATE INSTRUCTIONAL STRATEGIES

H. PLAN ACCOMMODATION OF INDIVIDUAL DIFFERENCES

I. DEVELOP INSTRUCTIONAL MATERIALS

J. EVALUATE INSTRUCTIONAL MATERIALS

X. INDEX

AUTHOR:

George L. Gropper

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VOLUMES IN THIS SERIES

1. USER'S MANUAL
2. ORIENTATION
3. HANDBOOK
   (eleven sub-volumes)
4. WORKBOOK
5. FINAL EXERCISES

FOREWORD

This is one of a series of eleven HANDBOOK sub-volumes which has been prepared to provide training for educational R&D personnel in the development of instructional materials.

The USER'S MANUAL, which accompanies the series, describes the role each volume is designed to play and the sequence recommended for its use in the training process. The user is, therefore, urged to read these instructions before using this or any other separate volume.

ACKNOWLEDGMENTS

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U.S.O.E. sponsorship does not in any way imply official endorsement of the views expressed in this volume.

The author is indebted: to Dr. Robert Fitzpatrick for reviewing portions of the series of volumes and for informal discussions concerning several training issues; to Mrs. Zita Glasgow for the first and critical use of this volume; and, not least, to Miss Kathleen Gubala for her tireless preparation of the complex manuscript required by this HANDBOOK.

George L. Gropper
~~[illegible]~~ 1973

TASK

C. SEQUENCE AND GROUP CRITERION BEHAVIORS

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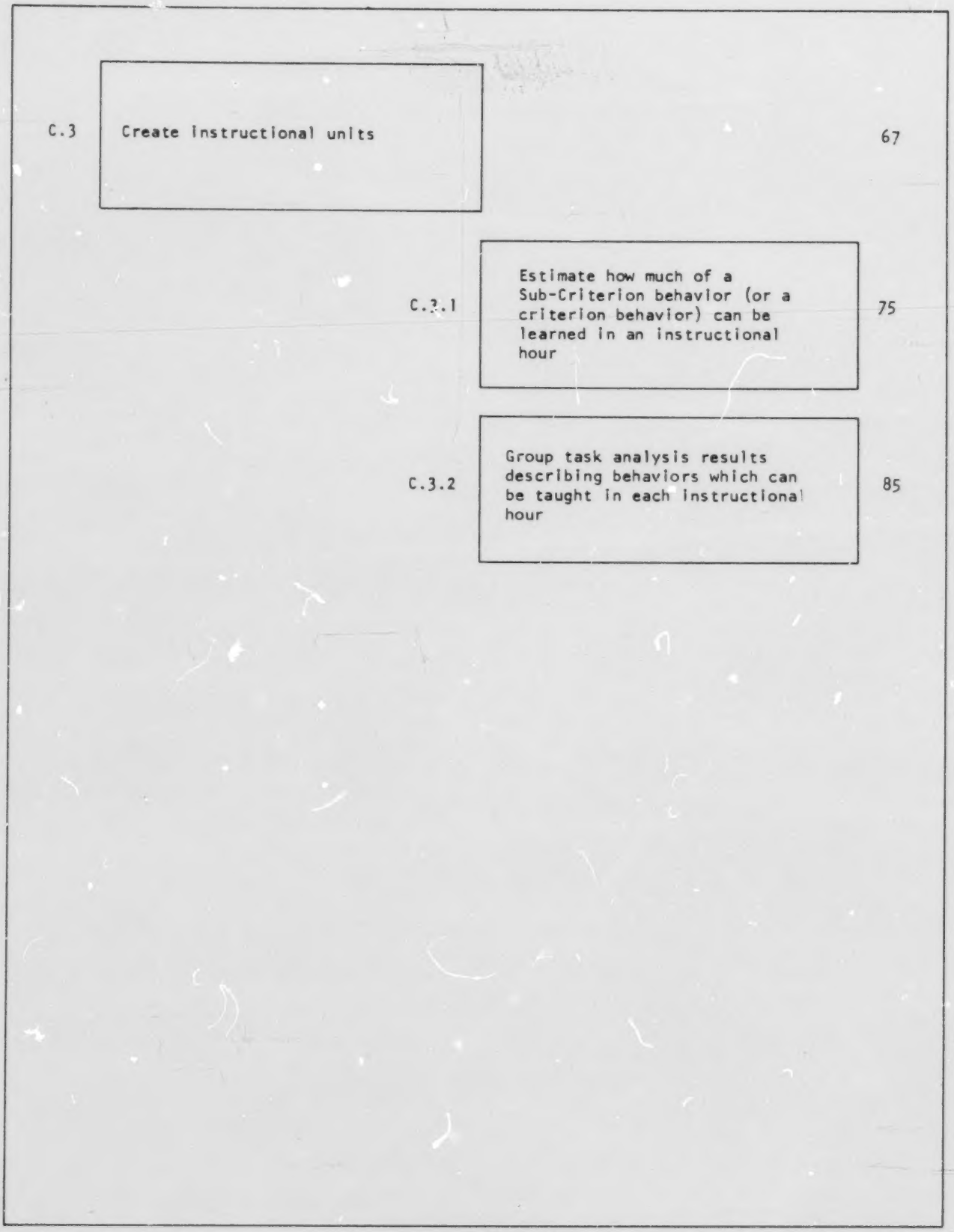
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C. IDENTIFICATION MATRIX

	TWO MAJOR PURPOSES IN MAKING SEQUENCING DECISIONS	
PURPOSES	To be able to schedule student learning of PREREQUISITE behaviors before the behaviors CONTINGENT on them	To be able to schedule student learning of FACILITATIVE behaviors before the behaviors which are FACILITATED by them
CRITERIA	-*To be able to learn one set of criterion behaviors, it is necessary, beforehand, to learn one or more sets of other criterion behaviors* -*Prior mastery of these other criterion behaviors is necessary because they are prerequisites to the mastery of the (one) criterion behavior at issue* -*Sequencing decisions concern the identification of criterion behaviors when mastery is prerequisite to the mastery of other criterion behaviors*	-*To be able to learn one set of criterion behaviors, it may be advantageous, beforehand, to learn one or more sets of other criterion behaviors* -*Prior mastery of these other criterion behaviors may be advantageous because they make it easier or more efficient to master the (one) criterion behavior at issue* -*Sequencing decisions concern the identification of criterion behaviors when mastery is facilitative of the mastery of other criterion behaviors*
EXAMPLES	e.g., -*The student bridge player cannot learn to bid or to play until he first learns:* ··*To identify suits* ··*To identify point values of a hand* -These behaviors (criterion or sub-criterion) are prerequisites for learning how to bid and/or how to play	e.g., -*The student bridge player can learn to "play" first or he can learn to "bid" first; neither is prerequisite to the other (although "bidding" is conventionally taught first)* -*Teaching "play" first, it is hypothesized, can facilitate the learning of "bidding" (the student learns first how the results of bidding are used as an aid in subsequently learning bidding)*

C.

IDENTIFICATION MATRIX

TWO MAJOR TYPES OF SEQUENCING DECISIONS

TYPES OF SEQUENCING DECISIONS	WITHIN a SINGLE criterion behavior	AMONG two or more criterion behaviors
CRITERIA	-*Each criterion behavior may be made up of two or more sub-criterion behaviors (or even one, if defined that way)**	-*Each instructional program may be made up of two or more criterion behaviors which can have a "prerequisite" or a "facilitative" effect on other criterion behaviors*
	-*Sequencing decisions concern the order in which:* ••*Each sub-criterion behavior is learned* ••*All the separate sub-criterion behaviors are finally integrated into a complete sub-criterion behavior*	-*Sequencing decisions concern the order in which:* ••*Each criterion behavior is learned* ••*Elements common to two or more criterion behaviors can be learned*
	-*These decisions are made in:* ••*STEP C.1 (in this section of the HANDBOOK)* *and* ••*TASK J (where decisions can be revised in the light of other strategy information obtained beyond TASK C)*	-*These decisions are made in:* ••*STEP C.2(in this section of the HANDBOOK)*

SEE NOTE ON NEXT PAGE

* NOTE

It is a matter of judgment as to how much of a performance or of a curriculum to label a CRITERION BEHAVIOR. Take as one example the instructional development process being discussed in these volumes. One might choose to call the whole development process the criterion behavior. Or, one might choose to call each of the major tasks a criterion behavior. Or, one might choose to call each of the steps within a task or each of the sub-steps within a step a criterion behavior. While there are some formal criteria suitable for making decisions of this type (see later), differing units of behavior can meet the criteria. Thus, for example, the units labeled tasks, steps, sub-steps, and even sub-sub-steps in these volumes can all meet the criteria. The decision as to which unit to settle on is, therefore, arbitrary.

For purposes of analysis, it probably makes little sense to label so complex and comprehensive a performance as the complete instructional development process as a single criterion behavior. It is likely to be broken up into multiple criterion behaviors.

Once the unit of behavior to be labeled a criterion behavior is settled on, the number of sub-criterion behaviors (meeting formal criteria for sub-criterion behaviors) into which a criterion behavior can be sub-divided is fixed. (Criteria for labeling behaviors as criterion, sub-criterion, or preparatory are provided in the "D" volume of the HANDBOOK.)

The guidelines for making sequencing decisions which are made in TASKS "C" and "G" -- based on relationships among multiple criterion behaviors, between a criterion behavior and its sub-criterion behaviors, or between multiple sub-criterion behaviors belonging to a single criterion behavior are applicable regardless of differing judgments as to the appropriate unit of bheavior to treat as a criterion behavior.

STEP C.1

C.1 Sequence task analysis results for all the Sub-Criterion behaviors which make up each criterion behavior.

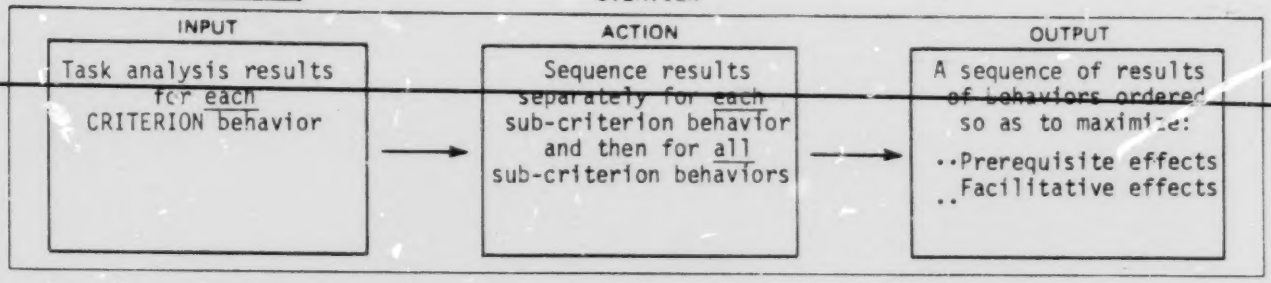
C.1.1 Sequence task analysis information describing all Sub-STEPS (or terminal behaviors) which make up each Sub-Criterion behavior.

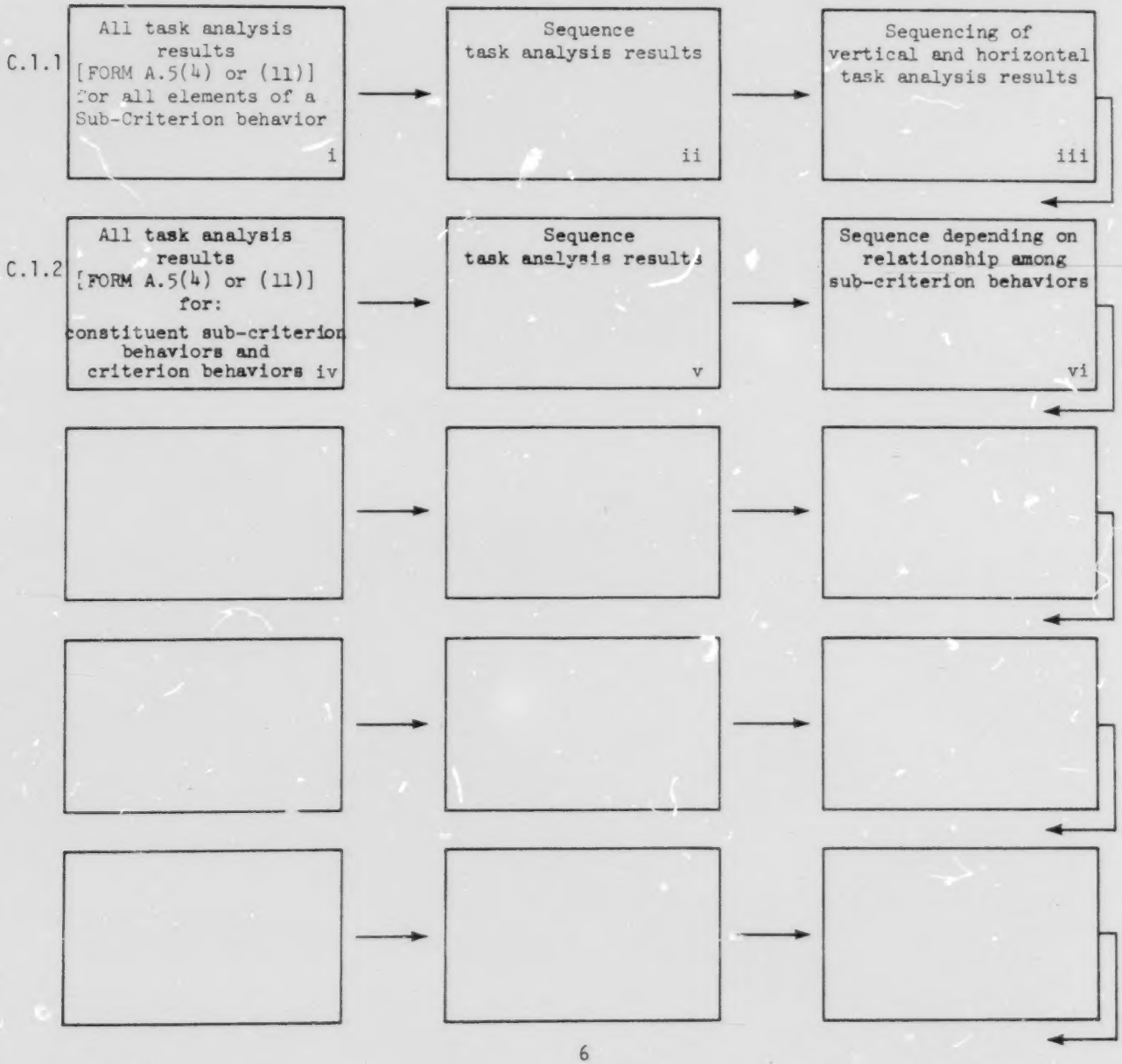
C.1.2 Sequence task analysis information describing all Sub-Criterion behaviors which make up each criterion behavior.*

There is ample opportunity during TASK "G" (STRATEGY FORMULATION) to change sequencing decisions in light of additional information.

STEP C.1

OVERVIEW


INPUT
ACTION
OUTPUT
Task analysis results for each CRITERION behavior
Sequence results separately for each sub-criterion behavior and then for all sub-criterion behaviors
A sequence of results of behaviors ordered so as to maximize:
..Prerequisite effects
..Facilitative effects


C.1.1
All task analysis results [FORM A.5(4) or (11)] for all elements of a Sub-Criterion behavior
i
Sequence task analysis results
ii
Sequencing of vertical and horizontal task analysis results
iii
C.1.2
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STEP C.1

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C.1
IDENTIFICATION
MATRIX

DEFINING "SUB-CRITERION" AND "CRITERION" BEHAVIOR

CONCEPTS	Sub-CRITERION behavior	CRITERION behavior
CRITERIA	*-A Sub-CRITERION behavior can consist of:* *··One or more performance Sub-STEPS* *or* *··One or more knowledge domain terminal behaviors* *-A Sub-CRITERION behavior usually has one or more of these properties:* *··An identifiable, logical end point* *··An identifiable OUTPUT (product or result)* *··An amount of behavior worth testing**	*-A CRITERION behavior can consist of:* *··Two or more Sub-CRITERION behaviors:* */Performance Sub-STEPS* *or* */Knowledge domain terminal behaviors* *-A CRITERION behavior has all of these properties:* *··An identifiable, logical end point* *··An identifiable OUTPUT (product or result)* *··An amount of behavior worth testing**

*In SECTION "D" the term preparatory objective is used to identify the behavior which is defined here as Sub-CRITERION.

EXAMPLES	e.g., KNOWLEDGE DOMAIN	e.g., KNOWLEDGE DOMAIN
	-In chemistry, a separate Sub-CRITERION behavior might be identified for each element in the periodic table; the terminal behavior being to list the properties of the elements (e.g., number of electrons and protons, atomic weights)	*-In chemistry, a criterion behavior might require the behavior of identifying the bases for the position in the periodic table of each element*
	e.g., PERFORMANCE	e.g., PERFORMANCE
	-In math, Sub-CRITERION behaviors related to the CRITERION behavior in the right-hand column might include: *··Estimating the "characteristic" of a number;* *··Looking up its "mantissa" on a table; etc.*	*-In math, a criterion behavior might require the ability to compute (e.g., multiply or divide) using logarithms*

C.1 IDENTIFICATION MATRIX	TWO TYPES OF SEQUENCING DECISIONS WHICH HAVE TO BE MADE CONCERNING EACH CRITERION BEHAVIOR	
TYPES OF SEQUENCING DECISIONS	Made in Sub-STEP C.1.1 TYPE I In what order should the hierarchical behaviors within a sub-criterion be sequenced?	Made in Sub-STEP C.1.2 TYPE II In what order should each of the two or more sub-criterion behaviors be sequenced?
CRITERIA	*-In TASK B, Sub-STEP B.4.3, when it was deemed appropriate, task analysis information at more and more specific levels of detail were obtained* *-In this Sub-STEP (C.1.1), it must now be decided in what order each of the separate task analyses at increasingly lower (i.e., more specific) levels of detail should be sequenced (and subsequently be taught in that order)*	*-In TASK B, Sub-STEP B.4.1, task description information for performance Sub-STEPS or for knowledge domain terminal behavior were sequenced in a preliminary order* *-In Sub-STEP C.1.2 and again in TASK J, further sequencing decisions are made concerning behaviors WITHIN a criterion behavior* *-The decision involves the order in which two or more sub-criterion behaviors at the same or coordinate level of detail should be sequenced*

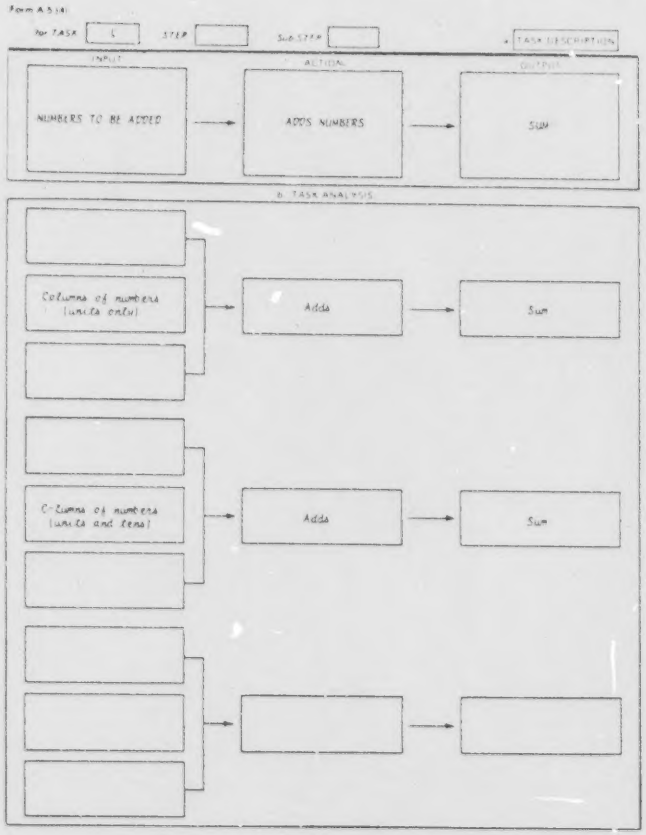
EXAMPLE	SEE OPPOSITE PAGE

C.1

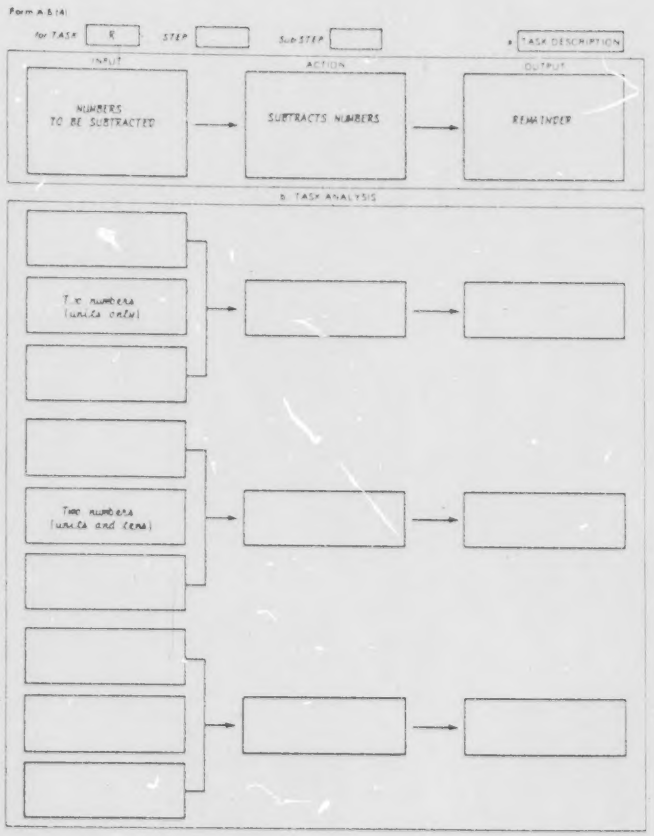
ILLUSTRATION IDENTIFYING TWO TYPES OF SEQUENCING DECISIONS CONCERNING EACH CRITERION BEHAVIOR

TYPE II

A



B

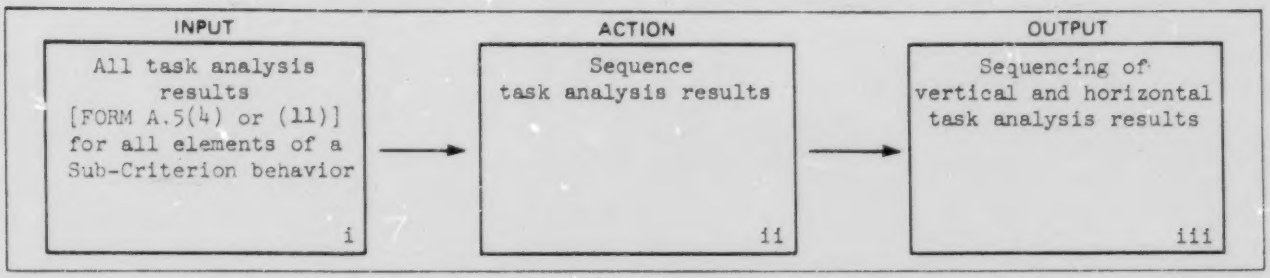


- *The criterion behavior requires the student to <u>divide</u>*
- *Two sub-criterion behaviors involved in this operation (and at a level lower than division as in Type I above) are: adding and subtracting*
- *These two sub-criterion behaviors are at the <u>same</u>, coordinate level of detail*
- The sequencing decision to be made is: in what order relative to one another should A and B (adding and subtracting) be taught

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*All the task analysis FORMS for elements of a Sub-Criterion behavior sequenced in an appropriate order:* ... *vertical results ordering prerequisite skills ahead of the skills in which they are contingent.* ... *horizontal results ordering skills in the sequence in which they are exhibited.*
WHAT YOU WILL WORK FROM	(1) All FORMS on which the task analyses have been recorded for all the elements of each Sub-Criterion behavior.
WHAT YOU WILL DO	(1) Sequence all vertical task analysis results in an appropriate order. (2) Sequence all horizontal task analysis results in an appropriate order.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	C.1.1



Job Aid Contents

CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
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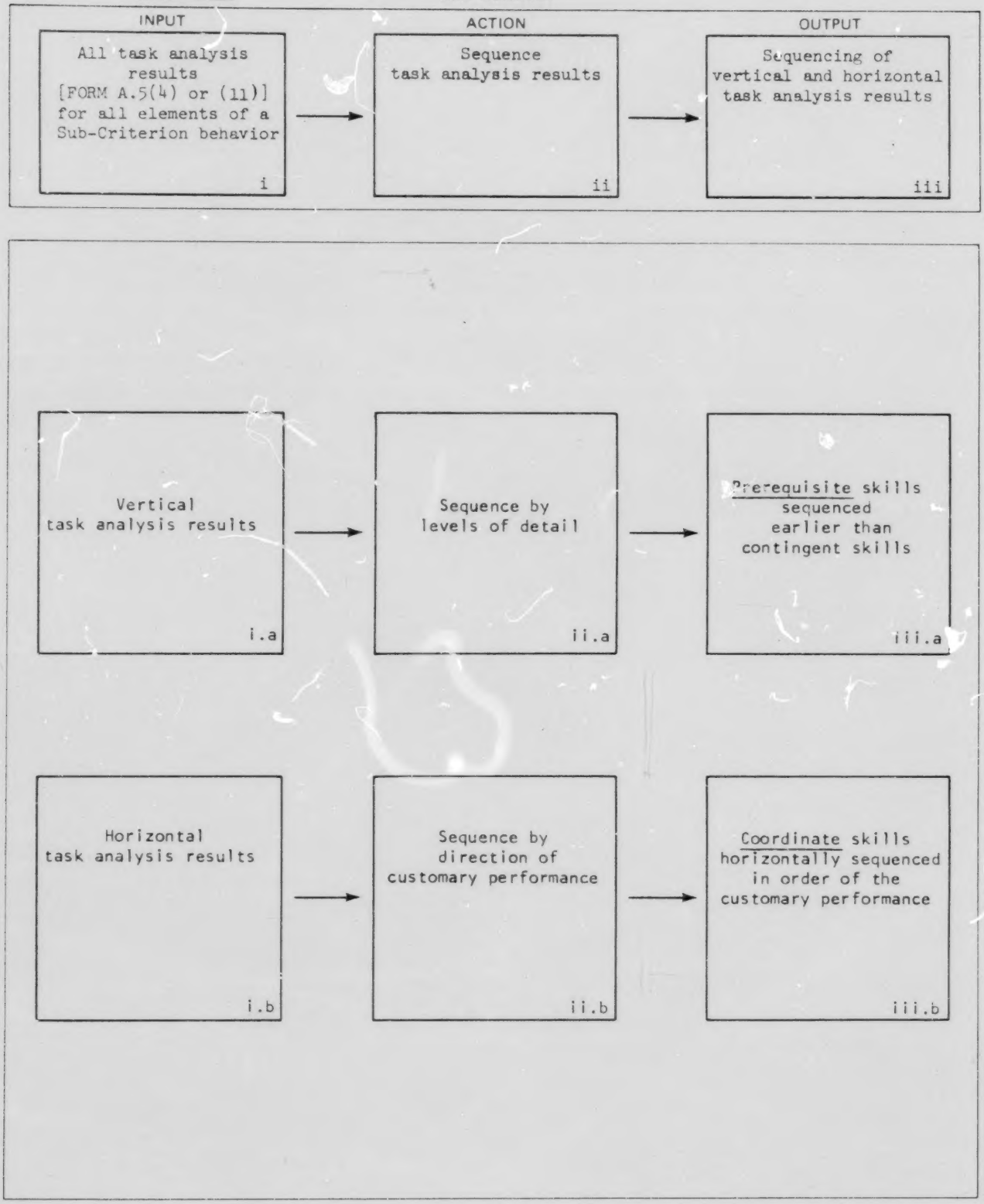
Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		Task analysis results on FORMS A.5(4) or (11) (carried forward from)	B.5	

Sub-**STEP** C.1.1

JOB DIAGRAM



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C.1.1
IDENTIFICATION
MATRIX

	TWO TYPES OF SEQUENCING DECISIONS WHICH HAVE TO BE MADE ABOUT PERFORMANCE SUB-STEPS WHICH MAKE UP A SUB-CRITERION BEHAVIOR	
TYPES OF SEQUENCING DECISIONS	Sequencing decision about VERTICALLY related task analysis results for a single Sub-STEP	Sequencing decision about HORIZONTALLY related task analysis results for two or more Sub-STEPS
CRITERIA	-*When a task analysis for a single Sub-STEP is judged to be at an insufficient level of detail (i.e., it is judged that students cannot take a required ACTION which is to be associated with an INPUT class), lower level, more specific task analyses are performed (See page 13)* -*The decision to be made involves these vertically arranged multiple levels of task analysis results:* ··*In what order should the task analysis results for these levels be arranged (becoming the basis for the order in which the skills they identify will be taught)?*	-*When a task analysis for two or more Sub-STEPS has been performed (for some of which vertical analyses have also been performed), the following sequencing decisions have to be made:* ··*In what order should the task analysis results for each Sub-STEP (relative to each other Sub-STEP) be sequenced* ··*Within the above sequence, in what order should vertical results for one (or more of the separate Sub-STEPS) be sequenced*

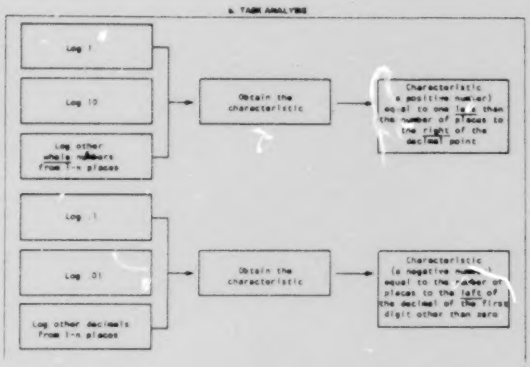
C.1.1

EXAMPLE (COMPUTATION OF LOGARITHMS) ILLUSTRATING HORIZONTAL AND VERTICAL SEQUENCING DECISIONS WHICH HAVE TO BE MADE

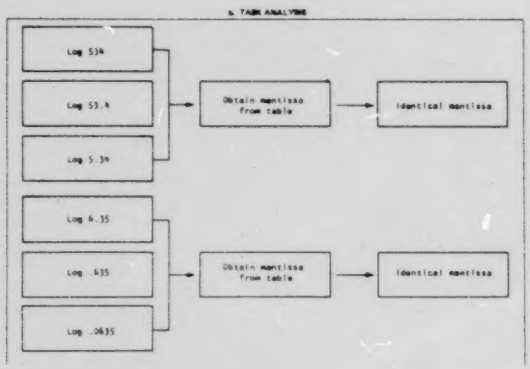
EXAMPLE

HORIZONTAL Decision

Task Analysis for Sub-STEP 1 (estimating characteristics)

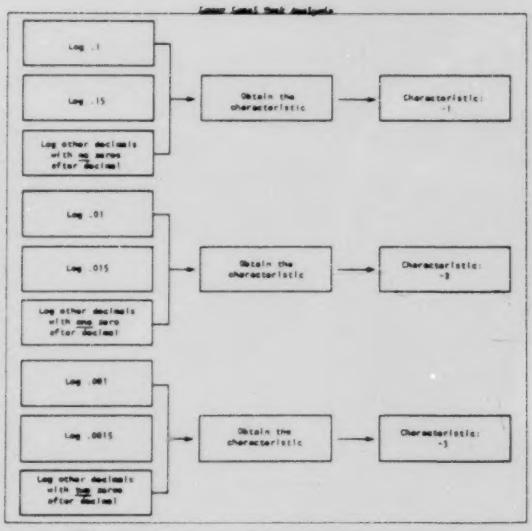


Task Analysis for Sub-STEP 2 (obtaining "mantissas" from logarithm tables)



In what order should the results for these two Sub-STEPS be sequenced (and then the two Sub-STEPS be taught)?

VERTICAL Decisions



- It was determined during task analysis that students did not know how to obtain a "characteristic" for decimal numbers. Accordingly, a lower level task analysis was performed yielding the results to the left. (If it were determined that the ACTIONS now diagrammed could not be taken, a still lower level of detail would have to be obtained.)
- The sequencing decision which has to be made: in what order is this diagram (to the left) to be sequenced relative to its parent (Sub-STEP 1) above.

C.1.1
DECISION
MATRIX

DETERMINING HOW TO MAKE SEQUENCING DECISIONS
ABOUT VERTICAL AND HORIZONTAL TASK ANALYSIS RESULTS

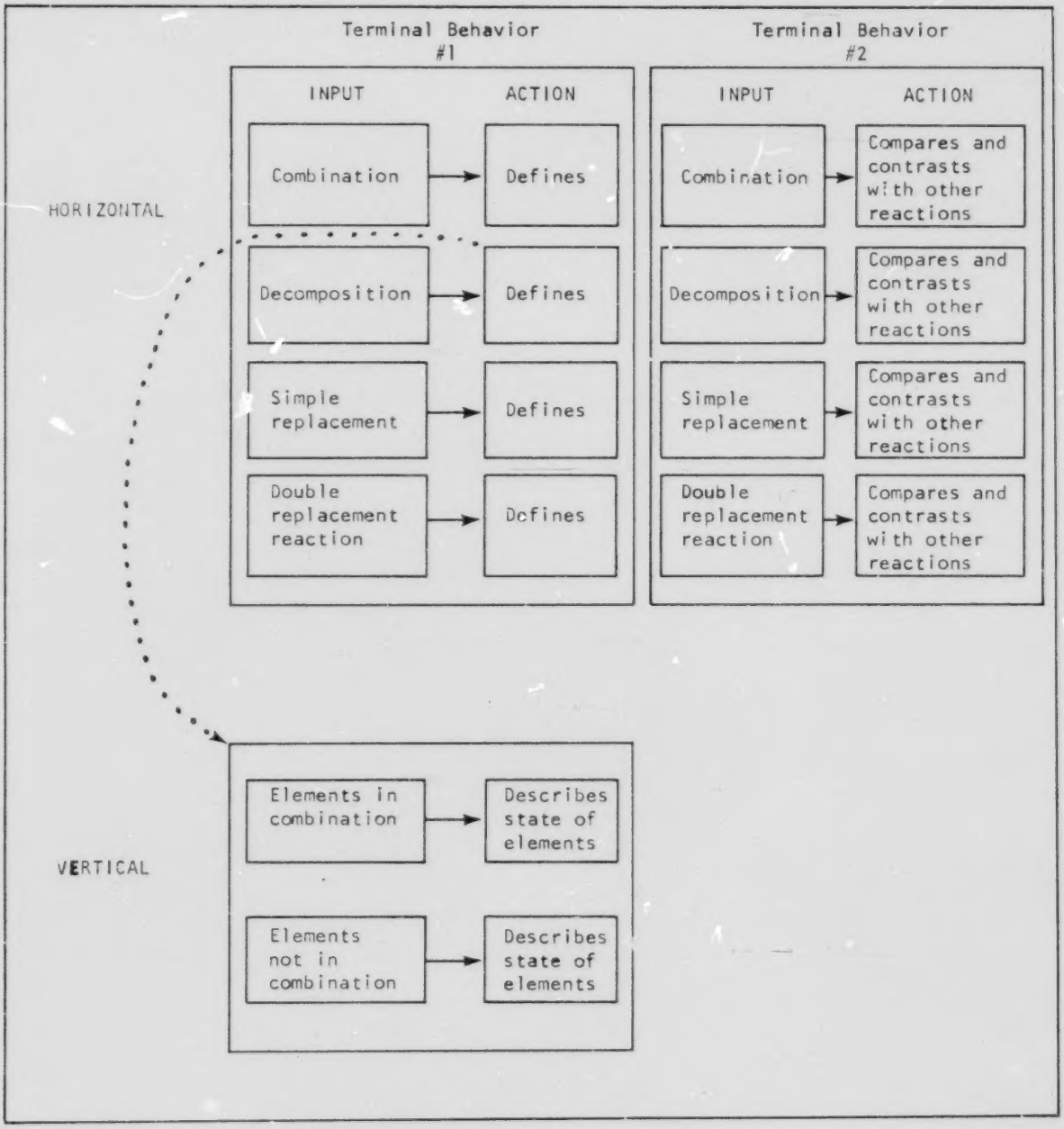
CONDITIONS	1 VERTICAL task analysis results	2 HORIZONTAL task analysis results	3 MIXED vertical and horizontal task analysis results
ACTION TO TAKE	*-Arrange the task analysis results in the following sequential order:* *··1st: lowest level analysis attained* *··2nd: next highest level analysis attained* *··3rd: next highest level analysis attained* ⋮ *··Last: Original task analysis for the Sub-STEP*	*-Arrange the task analysis results in the order in which each Sub-STEP in the Sub-Criterion behavior is performed:* *··1st: 1st Sub-STEP* *··2nd: 2nd Sub-STEP* *··3rd: 3rd Sub-STEP* ⋮ *··Last: Last Sub-STEP* *-Decisions about the order in which to teach these Sub-STEPS are made in TASK "G"*	*-Arrange results as in the middle column* *-For those individual Sub-STEPS (within this overall sequence) having "vertical" results, keep the order as performed in Column #1*
RATIONALE	-Lowest level results identify skills which are prerequisite to the learning of higher level skills -Within a Sub-STEP, lower level skills should be sequenced earlier (i.e., taught earlier)	-Skills for Sub-STEPS at coordinate levels can be taught in a forward or backward order -See TASK G for rationales for each order	-When instruction is provided for a Sub-STEP having vertical results (either in a forward or backward order relative to other Sub-STEPS): ··Lower level skills will be taught before higher level skills related to that Sub-STEP

C.1.1

DETERMINING HOW TO SEQUENCE VERTICAL AND HORIZONTAL RESULTS FOR KNOWLEDGE DOMAIN TERMINAL BEHAVIORS*

DECISION MATRIX

*A Sub-Criterion behavior in a knowledge domain may consist of one or more terminal behaviors. Procedures recommended for dealing with vertical and horizontal results for these terminal behaviors are identical with those recommended for performance Sub-STEPS - See opposite page.



JOB PROCEDURES

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C.1.1

ILLUSTRATION SUMMARIZING PROCEDURES FOR SEQUENCING ALL TASK ANALYSIS RESULTS FOR A SUB-CRITERION BEHAVIOR

#1

a. Create (or maintain) a forward order of task analysis results for all Sub-STEPS making up a performance Sub-Criterion behavior (or for all terminal behaviors making up a knowledge domain Sub-Criterion behavior)

#2

a. Identify each performance Sub-STEP (or each knowledge domain terminal behavior) which has had a task analysis performed to one or more lower levels of detail (Results on FORM A.5(4) for performance or A.5(11) for knowledge domain)

b. For those so identified, sequence task analysis results in the following order:

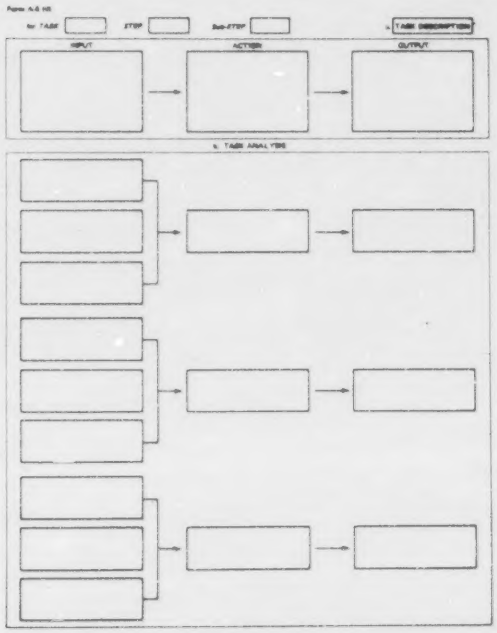
   ··Lowest levels first

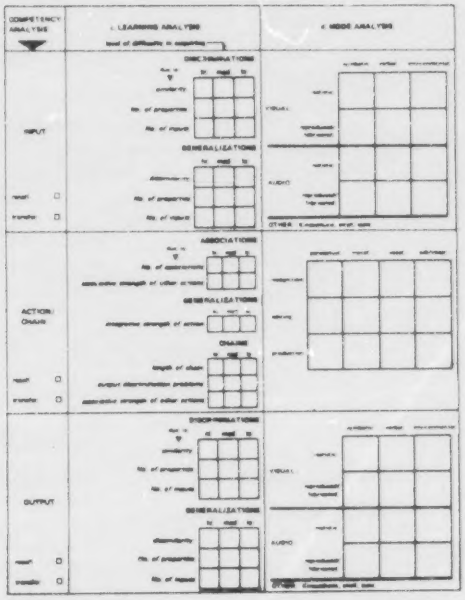
   ··Progress in an ascending order

   ··End with highest level analysis

c. Insert this ascending sequence within the forward order developed for all the separate Sub-STEPS (or terminal behaviors)

FORM A.5(4) or A.5(11)





C.1.1

STANDARDS MATRIX

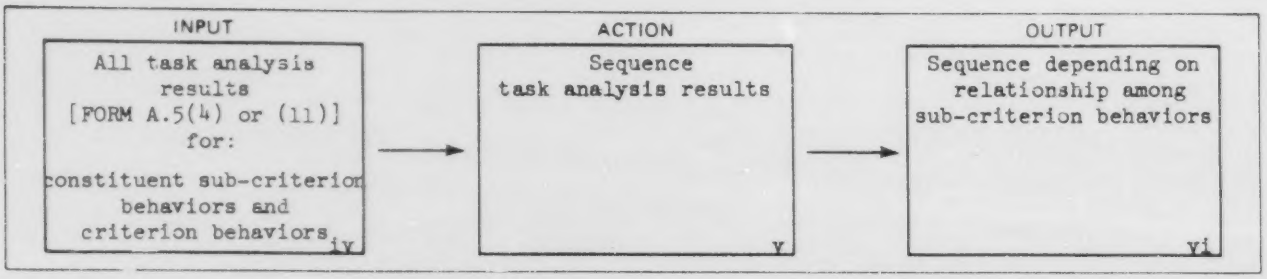
ASSESSING THE ADEQUACY OF PROCEDURES FOR SEQUENCING TASK ANALYSIS RESULTS FOR A SINGLE SUB-CRITERION BEHAVIOR

PROPERTIES	COMPLETENESS	ORDER
CRITERIA	-*Task analysis results are collected and organized for all elements of a Sub-Criterion behavior:* ••*All Sub-STEPS for a performance Sub-Criterion behavior* ••*All terminal behaviors for a knowledge domain Sub-Criterion behavior* -*Task analyses are collected and organized for elements of Sub-Criterion behaviors analyzed to lower levels of specificity or detail*	-*Horizontal results are sequenced in a forward direction (the same direction in which the separate behaviors are produced)* -*Vertical results are sequenced in order of prerequisite skills (prerequisite skills precede contingent skills)*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*FORMS for each Sub-Criterion behavior sequenced before or after those of other Sub-Criterion behaviors based on the relationship(s) of Sub-Criterion behaviors to each other.*
WHAT YOU WILL WORK FROM	(1) All FORMS on which task analyses are recorded for all Sub-Criterion behaviors which make up a criterion behavior (grouped for each Sub-Criterion behavior).
WHAT YOU WILL DO	(1) Inspect task analysis results for presence of each of three types of relationships among Sub-Criterion behaviors: ... shared elements ... contingent relationship ... prerequisite relationship (2) Order the FORMS for the separate Sub-Criterion behaviors based on their relationships to one another.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	C.1.2



Job Aid Contents

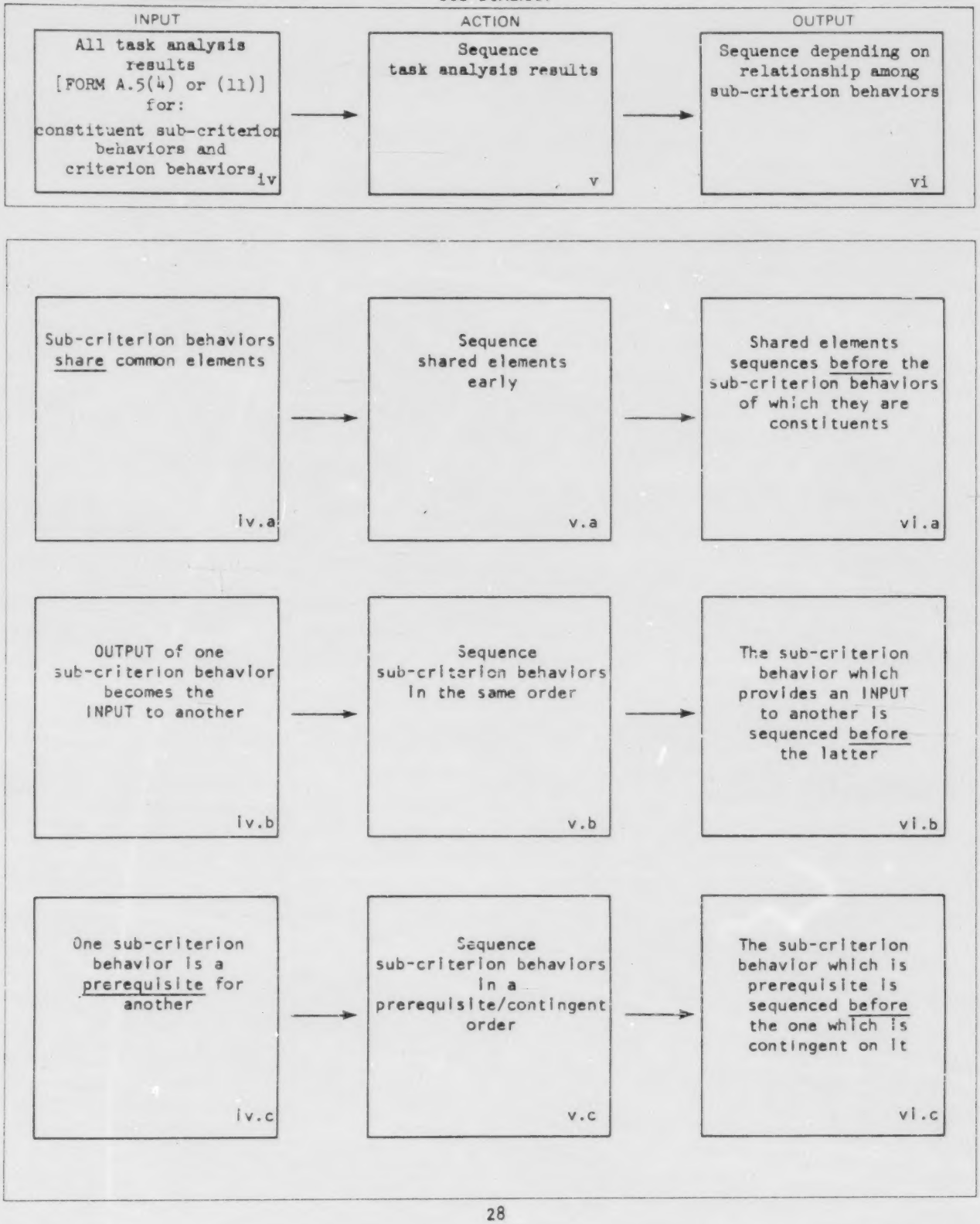
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Relationships which may exist among sub-criterion behaviors . . . 32	-MATRIX: Sequencing sub-criterion behaviors based on their relationships . 34	-MATRIX: Adequacy of sequencing of task analysis results 39	SUMMARY OF PROCEDURES . . .38

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		Task analysis results (carried forward from)	C.1.1	

STEP C.1.2

JOB DIAGRAM


INPUT
ACTION
OUTPUT
All task analysis results [FORM A.5(4) or (11)] for: constituent sub-criterion behaviors and criterion behaviors
iv
Sequence task analysis results
v
Sequence depending on relationship among sub-criterion behaviors
vi
Sub-criterion behaviors share common elements
iv.a
Sequence shared elements early
v.a
Shared elements sequences before the sub-criterion behaviors of which they are constituents
vi.a
OUTPUT of one sub-criterion behavior becomes the INPUT to another
iv.b
Sequence sub-criterion behaviors in the same order
v.b
The sub-criterion behavior which provides an INPUT to another is sequenced before the latter
vi.b
One sub-criterion behavior is a prerequisite for another
iv.c
Sequence sub-criterion behaviors in a prerequisite/contingent order
v.c
The sub-criterion behavior which is prerequisite is sequenced before the one which is contingent on it
vi.c

BACKGROUND INFORMATION

	page
Relationship between sub-criterion behaviors and criterion behaviors	30
Sequencing the task analysis results for separate sub-criterion behaviors and the criterion behavior based on them	31
Three conditions to consider in sequencing sub-criterion behaviors relative to one another	32, 33
Determining how to sequence sub-criterion behaviors, given each of the three conditions	34

C.1.2
IDENTIFICATION
MATRIX

	RELATIONSHIP BETWEEN CONSTITUENT SUB-CRITERION BEHAVIORS AND THE CRITERION BEHAVIOR CONTINGENT ON THEM	
BEHAVIOR	CRITERION* behavior	Constituent Sub-CRITERION behaviors
CRITERIA	*-A criterion behavior is self-contained, with an identifiable end point, and with an identifiable outcome or product* *-A criterion behavior may be divisible into two or more sub-criterion behaviors, each of which is also self-contained, contains an identifiable end point, or contains an identifiable outcome or product* *-Performance of the criterion behavior is contingent on the ability to perform its constituent sub-criterion behaviors*	*-Each of the two or more sub-criterion behaviors which make up a criterion behavior is self-contained, with an identifiable end point, and with an identifiable outcome or product* *-Each sub-criterion behaviors bears some kind of relationship to one or more of the remaining sub-criterion behaviors which make up the criterion behavior (See page 32)* *-Performance of each sub-criterion behavior may or may not be contingent on the ability to perform another*
EXAMPLES	e.g., DIVISION *-Performing long or short division may be labeled a criterion behavior. It is a self-contained behavior having an identifiable end point and OUTPUT* *-It is a criterion behavior whose performance is contingent on such sub-criterion behaviors as subtraction and multiplication*	e.g., SUBTRACTION AND MULTIPLICATION *-In performing long division, subtraction and multiplication constitute elements in a chain (i.e., you subtract after you multiply)*

*As pointed out earlier, what one developer identifies as a sub-criterion behavior another developer might identify as a criterion behavior. A sub-criterion behavior now labeled as a "criterion" behavior is obviously smaller in scope. There are no rules for labeling one way or the other; it is arbitrary. Procedures for dealing with them do not depend on the scope of what is included--as long as the basic relationships between a behavior and its constituent elements are observed.

C.1.2

DECISION **MATRIX**

DETERMINING HOW TO SEQUENCE THE TASK ANALYSIS RESULTS FOR A CRITERION BEHAVIOR RELATIVE TO ITS CONSTITUENT SUB-CRITERION BEHAVIORS

TYPE OF TASK ANALYSIS RESULTS	Task analysis results for a CRITERION behavior	Task analysis results for constituent Sub-CRITERION behaviors
ACTION TO TAKE	*-Sequence the task analysis results which identify how the sub-criterion behaviors are chained together:* *••AFTER those for constituent sub-criterion behaviors*	*-Sequence the task analysis results for constituent sub-criterion behaviors:* *••BEFORE those for the CRITERION behavior*
EXAMPLE	CRITERION behavior: *Stating the relationships (i.e., producing a chain) involved in concepts that define Archimedes' principle* -Sequence the diagrams for this chain following the diagrams for the individual concepts (sub-criterion behaviors)	Sub-CRITERION behaviors: *Define or exemplify:* *••Weight of displaced fluid* *••Magnitude of buoyant force* *••Magnitude of apparent loss of weight* -Diagrams for these sub-criterion behaviors should precede the final ones for the criterion behavior

C.1.2
IDENTIFICATION
MATRIX

CONDITIONS TO BE CONSIDERED WHEN DETERMINING THE SEQUENCE OF TASK ANALYSIS RESULTS FOR EACH SUB-CRITERION BEHAVIOR RELATIVE TO OTHER CONSTITUENT SUB-CRITERION BEHAVIORS

CONDITIONS	1 Sub-Criterion Behaviors SHARE COMMON ELEMENTS	2 One Sub-Criterion Behavior PROVIDES AN INPUT to another Sub-Criterion Behavior	3 One Sub-Criterion Behavior IS A PREREQUISITE for another Sub-Criterion Behavior
CRITERIA	-*Two or more sub-criterion behaviors analyzed to lower or specific levels of detail are revealed to share:* ••*One or more Sub-STEPS (for performance) or terminal behaviors (for knowledge domain)* *OR* ••*One or more component skills (i.e., discriminations, generalizations, or associations)*	-*A sub-criterion behavior results in a final OUTPUT which, in turn, becomes an INPUT for another sub-criterion behavior (a horizontal relationship)*	-*The mastery of one sub-criterion behavior is contingent on the prior mastery of another sub-criterion behavior* -*These sub-criterion behaviors are thus in a vertical relationship to one another (i.e., a lower level task analysis of the contingent sub-criterion behavior would reveal the prerequisite one)* -*They are not in a coordinate, horizontal relationship*
EXAMPLES	e.g., PLAYING BRIDGE -*In both "play" and "bidding," the player has to be able (among other things) to:* ••*Identify suits* ••*Identify honor cards and numbered cards* ••*Identify higher and lower cards*	e.g., COMPUTING STATISTICS -*The OUTPUT of a computational Sub-STEP, treated as a sub-criterion behavior (e.g., the value of i)* -*Becomes the INPUT for another Sub-STEP (i.e., looking up the significance in a table), also treated as a sub-criterion behavior*	e.g., PHYSICS -*The concepts of "force" and "pressure" are initially treated as coordinate sub-criterion behaviors* -*Further analysis shows that dealing with "pressure" is contingent on being able to deal with "force" (i.e., a lower level concept)*

C.1.2

ADDITIONAL EXAMPLES ILLUSTRATING THREE RELATIONSHIPS SUB-CRITERION BEHAVIORS CAN BEAR TO ONE ANOTHER

EXAMPLES

1. SHARING COMMON ELEMENTS

Sub-Criterion Behavior #1

In a final report describing the research design for an experimental study

Sub-Criterion Behavior #2

In a final report interpreting the statistical analysis of the results of the study

- The two Sub-Criterion behaviors share common component skills:
  - ··*The ability to identify and describe the conditions necessary for the use of particular types of statistical analysis;*
  - ··*In the case of "designing a study," a design must be created which meets the conditions for the use of particular types of statistical analysis; in the case of writing a report on the results, the writer must be able to assess the adequacy with which assumptions and conditions were met*
- In teaching the writing of research reports, i.e., how to write about: statement of the problem, describing the method (including describing the design), reporting results, and including a discussion and statement of conclusions, it might be beneficial to teach conditions and assumptions for use and interpretation of results of types of statistical analysis early in the sequence before each Sub-Criterion (proper) is taught.

2. PROVIDING INPUTS TO ONE ANOTHER

Sub-Criterion Behavior #1

Given a physics problem to solve, identifying the appropriate formula to use in solving it (e.g., formula for Ohm's Law)

Sub-Criterion Behavior #2

Substituting the values from the problem in the formula for Ohm's Law

Sub-Criterion Behavior #3

Doing the computational work

- The OUTPUT of each of the Sub-Criterion behaviors becomes an INPUT for the next Sub-Criterion behavior in the chain.

3. ARE PREREQUISITE TO ONE ANOTHER

Sub-Criterion Behavior #1

Defining or giving examples of balanced or unbalanced forces

Sub-Criterion Behavior #2

Defining or giving an example of what a "force" is

Sub-Criterion Behavior #3

Defining or giving an example of "strength" of a force

- Sub-Criterion Behavior #2 is clearly prerequisite to #1 and #3. Without being able to define, or illustrate, or pick out an example of, etc., a force, the learner cannot be expected to deal with concepts of balanced or unbalanced forces or with the concept of "strength of force"
- Also, Sub-Criterion behavior #3 is prerequisite to #1

C.1.2

DECISION MATRIX

DETERMINING HOW TO SEQUENCE SUB-CRITERION BEHAVIORS BEARING EACH OF THREE POSSIBLE RELATIONS TO ONE ANOTHER

CONDITIONS	1 Sub-Criterion Behaviors SHARE COMMON ELEMENTS	2 One Sub-Criterion Behavior PROVIDES AN INPUT to another Sub-Criterion Behavior	3 One Sub-Criterion Behavior IS A PREREQUISITE for another Sub-Criterion Behavior
ACTION TO TAKE	-*Sequence task analysis results for elements shared with several sub-criterion behaviors FIRST in line* -*(Subsequently, instruction for these elements will precede instruction for the intact sub-criterion behaviors)* -*Sequence results for sub-criterion behaviors proper (with duplicate results inserted for elements removed) according to recommendations in other columns*	-*Sequence task analysis results in the order in which sub-criterion behaviors are to one another in usual performance:** ··*Sub-criterion behaviors which provide an INPUT to another sub-criterion behavior are sequenced BEFORE the sub-criterion behavior to which it makes an INPUT* ··*Sub-criterion behaviors which take as INPUTS OUTPUTS from another sub-criterion behavior are sequenced AFTER the sub-criterion behavior whose OUTPUT provided the INPUT*	-*Sequence task analysis results for sub-criterion behaviors in the direction of the contingent relationship:* ··*Prerequisite sub-criterion behaviors BEFORE the sub-criterion behavior which is contingent on it* ··*The sub-criterion behavior contingent on another sub-criterion behavior AFTER the sub-criterion behavior on which it is contingent* -*The subsequent sequencing of instruction will follow this order*

*Ultimate sequencing decisions are made in TASK G

EXAMPLES	e.g., -*The concepts (discriminations, generalizations, associations, and chains) appear in most of the ten TASKS described in the ten volumes of this HANDBOOK* -*It is likely to be effective (facilitative) and efficient to teach them first (no matter whether instruction begins with TASK A or with TASK J)*	e.g., -*The ten major tasks identified in this HANDBOOK (i.e., A-J) (if treated as sub-criterion behaviors) provide INPUTS to one another and therefore would be sequenced in the order A through J* -*In TASK G, it might subsequently be decided to teach them in the order J through A*	e.g., -*If it were judged that "preparatory instructional materials" is a prerequisite for "revising instructional materials," then they would be sequenced with "preparation" coming beforehand (i.e., first)* (No such assumption is necessarily being proposed here)

JOB PROCEDURES

	page
Information to review in order to make sequencing decisions	37
SUMMARY OF PROCEDURES	38
Adequacy of procedures for sequencing task analysis results for constituent elements of a criterion behavior	39

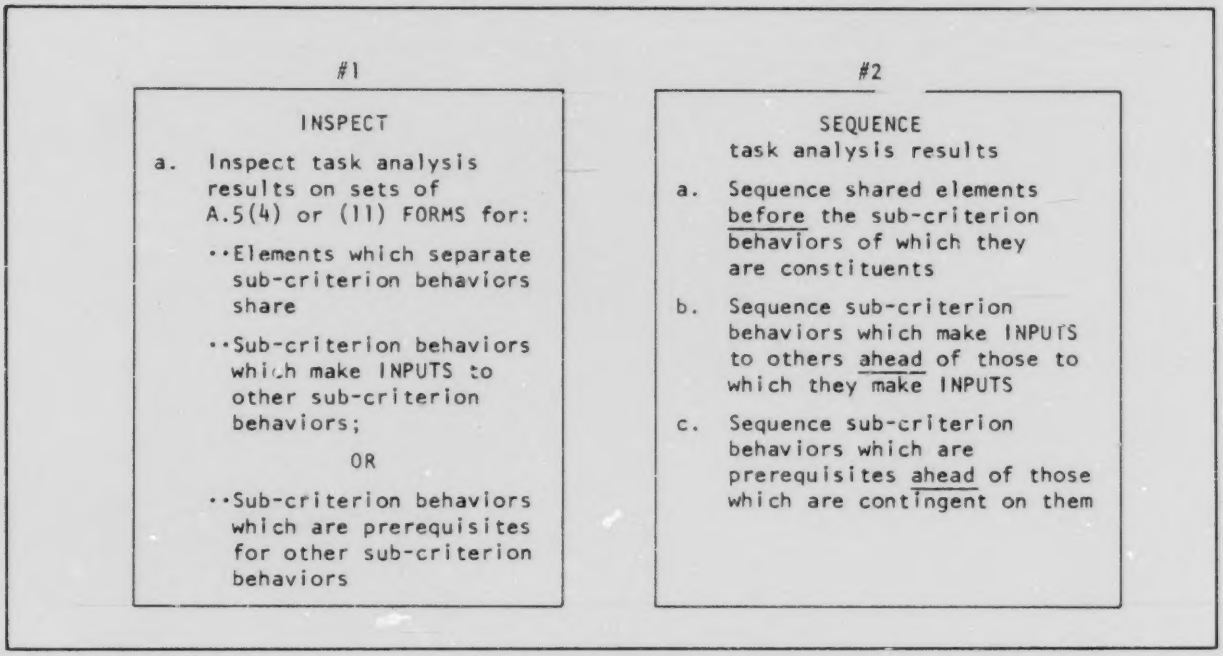
C.1.2
DECISION
MATRIX

INFORMATION TO REVIEW IN ORDER TO IDENTIFY
CONDITIONS WHICH DETERMINE SEQUENCING DECISIONS

TO IDENTIFY	Condition: 1 Sub-Criterion Behaviors SHARE COMMON ELEMENTS	Condition: 2 One Sub-Criterion Behavior PROVIDES AN INPUT to another Sub-Criterion Behavior	Condition: 3 One Sub-Criterion Behavior IS A PREREQUISITE for another Sub-Criterion Behavior
ACTION TO TAKE	*-Lay out all task analysis results on sets of FORM A.5(4) or (11) for each sub-criterion behavior*		
	-Inspect in each set for identical task analysis results appearing in other sets, revealing shared: *··Performance Sub-STEPS or knowledge domain terminal behaviors* *··Individual component skills* *··Combinations of component skills* *-Determine the frequency of occurrence of these shared elements:* *··In how many of the sub-criterion behaviors do they occur?* *-Consider sequencing frequently occurring elements before the sub-criterion behaviors in which they occur*	*-Inspect the original sequencing of task analysis results in order to identify:* *··Sub-criterion behaviors which constitute parts of a total chain with each sub-criterion behavior producing OUTPUTS which become INPUTS for the next sub-criterion behavior in the chain* *-Consider maintaining the forward direction of the originally formed sequence of results (with final sequencing decisions involving such chains as those made in TASK G)*	*-Inspect for each sub-criterion behavior the lower level, more specific task analysis results and the analyses for other sub-criterion behaviors to determine whether:* *··What has been (arbitrarily) identified or labeled as a coordinate (same level) sub-criterion behavior is in fact a prerequisite behavior--to be arranged vertically with respect to the sub-criterion behavior which is contingent on it*

C.1.2

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN MAKING SEQUENCING DECISIONS ABOUT SUB-CRITERION BEHAVIORS


#1
INSPECT
a. Inspect task analysis results on sets of A.5(4) or (11) FORMS for:
··Elements which separate sub-criterion behaviors share
··Sub-criterion behaviors which make INPUTS to other sub-criterion behaviors;
OR
··Sub-criterion behaviors which are prerequisites for other sub-criterion behaviors
#2
SEQUENCE
task analysis results
a. Sequence shared elements before the sub-criterion behaviors of which they are constituents
b. Sequence sub-criterion behaviors which make INPUTS to others ahead of those to which they make INPUTS
c. Sequence sub-criterion behaviors which are prerequisites ahead of those which are contingent on them

C.1.2

STANDARDS MATRIX

ASSESSING THE ADEQUACY OF PROCEDURES FOR SEQUENCING SUB-CRITERION BEHAVIORS

PROPERTIES	COMPLETENESS	RELEVANCE
CRITERIA	-*All relevant task analysis results (on complete sets of FORM A.5(4) or (11)) are reviewed*	-*Task analysis results are reviewed for relevant conditions:* ••*Shared elements* ••*OUTPUTS of one sub-criterion behavior providing an INPUT to another sub-criterion behavior* ••*Prerequisite/contingent relationship between sub-criterion behaviors*

STEP C.1

COMPLETION CHECKLIST

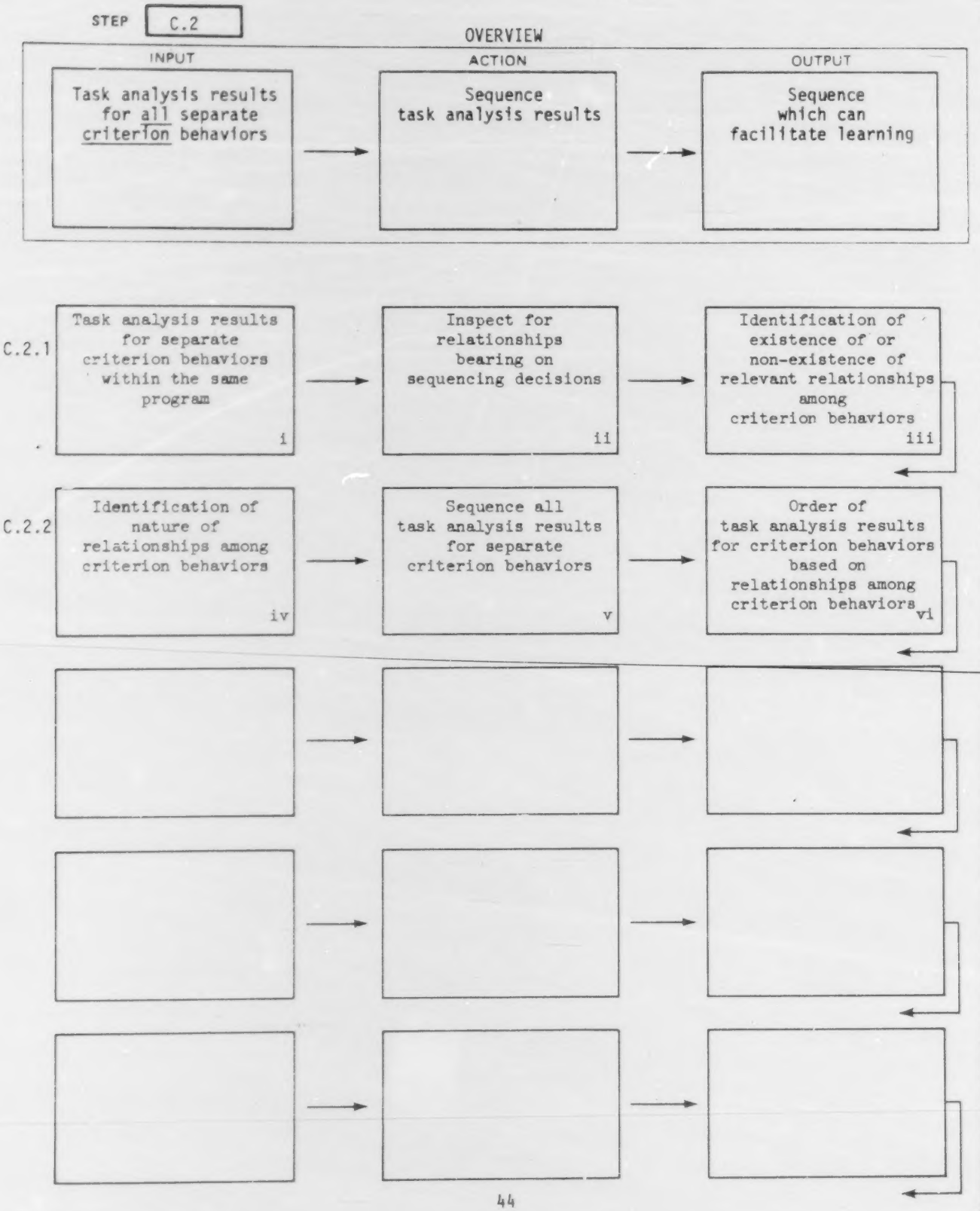
	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
C.1.1		Elements within a sub-criterion behavior sequenced		
C.1.2		Sub-criterion behaviors sequenced relative to one another		

STEP C.2

C.2 Sequence task analysis results for all the criterion behaviors which make up an instructional program.

C.2.1 Review task analysis results for all separate criterion behaviors for all properties relevant to sequencing decisions.

C.2.2 Sequence task analysis results for all criterion behaviors.


STEP C.2
OVERVIEW
INPUT
ACTION
OUTPUT
Task analysis results for all separate criterion behaviors
Sequence task analysis results
Sequence which can facilitate learning
C.2.1
Task analysis results for separate criterion behaviors within the same program
i
Inspect for relationships bearing on sequencing decisions
ii
Identification of existence of or non-existence of relevant relationships among criterion behaviors
iii
C.2.2
Identification of nature of relationships among criterion behaviors
iv
Sequence all task analysis results for separate criterion behaviors
v
Order of task analysis results for criterion behaviors based on relationships among criterion behaviors
vi

STEP C.2

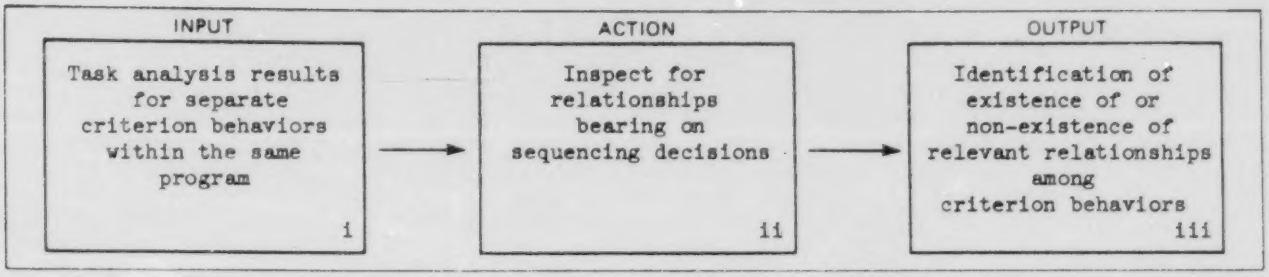
PAGE INDEX

	CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
C.2.1	-MATRIX: Types of relationships among criterion behaviors . . . 51		-MATRIX: Adequacy of identification of relationships among criterion behaviors . . . 55	SUMMARY OF PROCEDURES . . .54
C.2.2		-MATRIX: How to sequence separate criterion behaviors . . . 61	-MATRIX: Adequacy of sequencing of criterion behaviors . . . 63	SUMMARY OF PROCEDURES . . .62

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*An identification of the relationships existing among all the separate criterion behaviors which make up an instructional program.*
WHAT YOU WILL WORK FROM	(1) FORMS on which are recorded task analysis results for all the separate criterion behaviors making up an instructional program.
WHAT YOU WILL DO	(1) Inspect task analysis results for relationships among criterion behaviors: ... none ... shared elements ... contingent relationship ... prerequisite relationship
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	C.2.1


INPUT
Task analysis results for separate criterion behaviors within the same program
i
ACTION
Inspect for relationships bearing on sequencing decisions
ii
OUTPUT
Identification of existence of or non-existence of relevant relationships among criterion behaviors
iii

Job Aid Contents

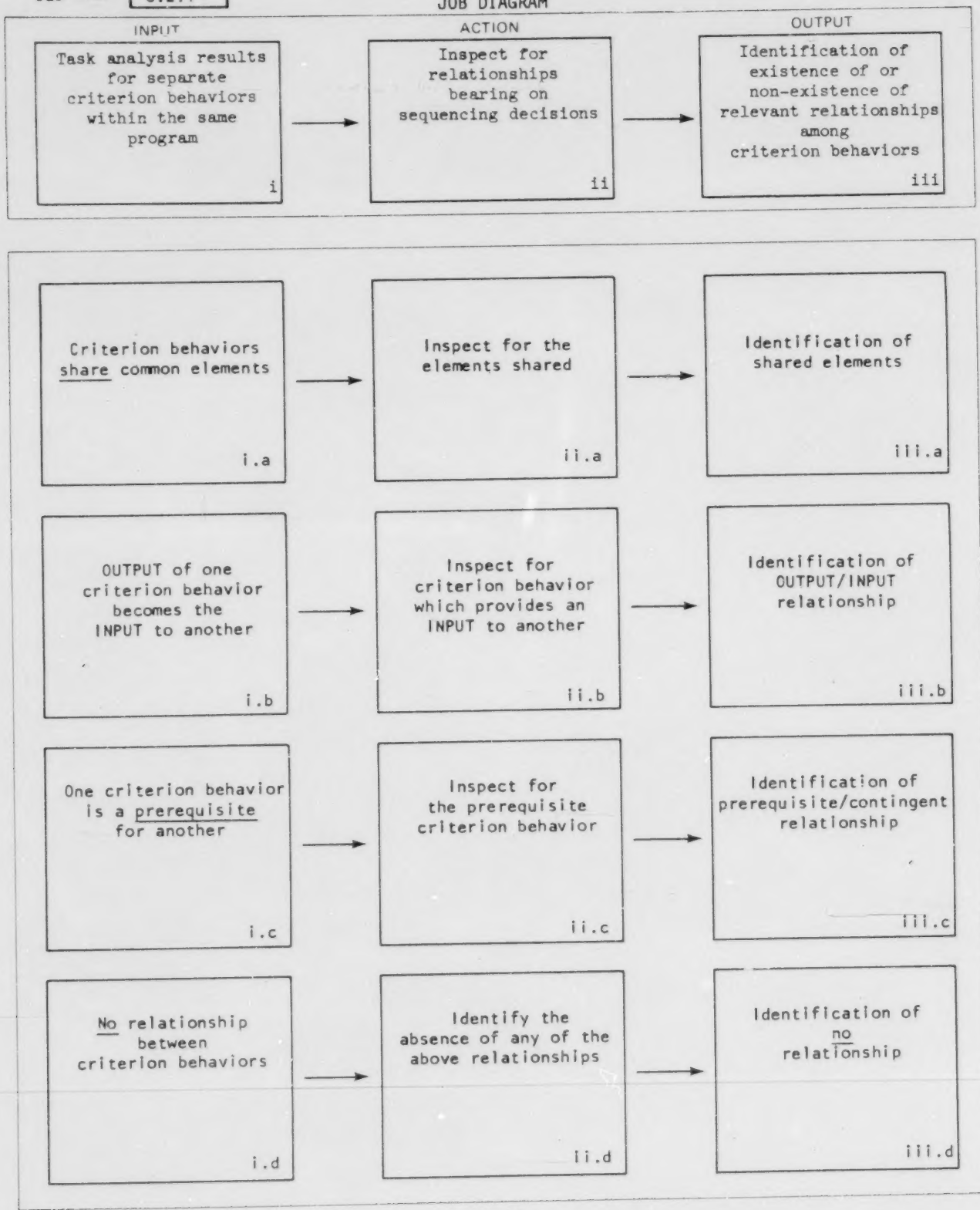
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Types of relationships among criterion behaviors . . . 51		-MATRIX: Adequacy of identification of relationships among criterion behaviors . . . 55	SUMMARY OF PROCEDURES . . . 54

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		FORM A.5(4) or (11) (carried forward from)	C.1.2	

Sub-STEP C.2.1

JOB DIAGRAM



BACKGROUND INFORMATION

	page
Dealing with separate criterion behaviors	50
Relationship between separate criterion behaviors	51, 52

*

The procedures recommended for identifying relationships among sub-criterion behaviors and making sequencing decisions based on them are equally applicable to CRITERION behaviors. Criterion behaviors may: (a) share common elements with other criterion behaviors; (b) make INPUTS to other criterion behaviors; or (c) be prerequisites to other criterion behaviors.

In addition, they may bear no relationship to other criterion behaviors except for being part of the same program (See opposite page).

BACKGROUND INFORMATION

	page
Dealing with separate criterion behaviors	50
Relationship between separate criterion behaviors	51, 52

*

The procedures recommended for identifying relationships among sub-criterion behaviors and making sequencing decisions based on them are equally applicable to CRITERION behaviors. Criterion behaviors may: (a) share common elements with other criterion behaviors; (b) make INPUTS to other criterion behaviors; or (c) be prerequisites to other criterion behaviors.

In addition, they may bear no relationship to other criterion behaviors except for being part of the same program (See opposite page).

C.2.1
IDENTIFICATION
MATRIX

CONDITIONS TO BE IDENTIFIED AS A BASIS FOR DECISIONS ABOUT SEQUENCING TASK ANALYSIS RESULTS FOR SEPARATE CRITERION BEHAVIORS		
CONDITIONS	RELATIONSHIPS EXIST BETWEEN SEPARATE CRITERION BEHAVIORS	RELATIONSHIPS DO NOT EXIST BETWEEN SEPARATE CRITERION BEHAVIORS
CRITERIA	-*CRITERION behaviors share common elements:* ••*Share a sub-criterion behavior* ••*Share components of a sub-criterion behavior* -*The OUTPUT of one criterion behavior becomes the INPUT for another criterion behavior* -*A criterion behavior is a prerequisite for another criterion behavior*	-*Criterion behaviors do not bear any relationship to one another* -*They are simply separate criterion behaviors within the same overall program*
EXAMPLES	See Sub-STEP C.1.2 (page 32) for treatment of these conditions as they pertain to two or more sub-criterion behaviors which are constituent elements of a single criterion behavior	e.g., PHYSICS -*Criterion behaviors involving "light" and "work"*

C.2.1

EXAMPLES ILLUSTRATING THE RELATIONSHIPS SEPARATE CRITERION BEHAVIORS BEAR TO ONE ANOTHER*

EXAMPLES

#1. SHARED ELEMENTS

e.g., *the piano student (other instrumentalists or singers), whether learning to play solo works or concertos, or whether learning to play baroque, romantic, or modern pieces (each type treated as a criterion behavior), has to be able to observe "rules" about phrasing, or rhythm, or tone quality.*

These shared elements might properly be taught in advance of all those criterion behaviors which share them.

e.g., *if a variety of mathematical computations are to be done by means of logarithms, logarithms becomes a "shared element" (as well as a prerequisite).*

#2. OUTPUT OF ONE BECOMES AN INPUT FOR ANOTHER

e.g., *in "instructional development" the "formulation of an instructional strategy" creates an OUTPUT which becomes an INPUT for the actual "development of instructional materials"*

#3. PREREQUISITE/CONTINGENT

e.g., *in studying magnetic fields, the student has to relate the field to the electric current which produces it.*

Accordingly, "electric current" may properly be considered a prerequisite to criterion behavior (one which should be taught before magnetic fields).

#4. NO RELATIONSHIP

e.g., *"trigonometric functions" and "probability statistics" bear to each other none of the relationships described in #'s 1, 2, or 3*

*Some developers might have called the behaviors illustrated "Sub-Criterion" behaviors. Whether they are dubbed Sub-Criterion or Criterion, in the end, makes no practical difference; the same type of analysis is made.

JOB PROCEDURES

	page
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Adequacy of procedures for identifying relationships among separate criterion behaviors	55

C.2.1

ILLUSTRATION SUMMARIZING PROCEDURES INVOLVED IN IDENTIFYING RELATIONSHIPS AMONG SEPARATE CRITERION BEHAVIORS WITHIN THE SAME PROGRAM

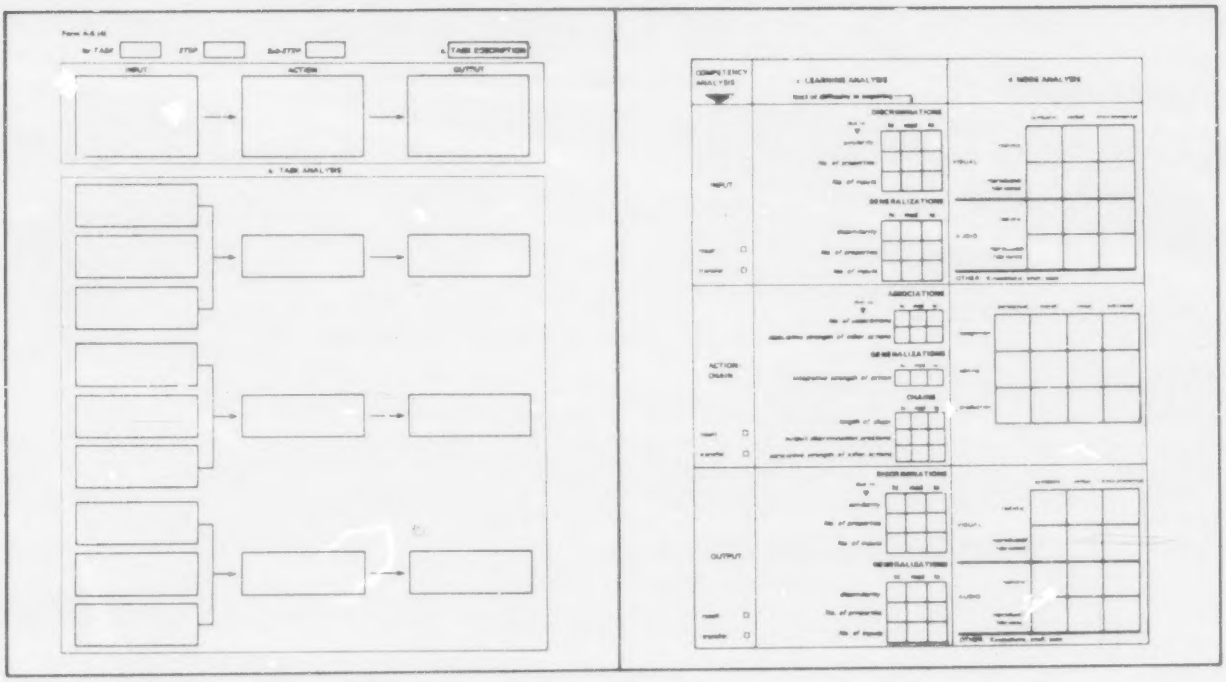
#1

a. INSPECT task analysis results for each criterion behavior on sets of A.5(4) or (11) FORMS

b. IDENTIFY:

- ··Elements which two or more criterion behaviors share
- ··Criterion behaviors whose OUTPUTS become the INPUTS for other criterion behaviors
- ··Criterion behaviors which are prerequisites for other criterion behaviors
- ··Criterion behaviors which bear none of the above relationships to one another

FORM A.5(4) or A.5(11)



C.2.1
STANDARDS
MATRIX

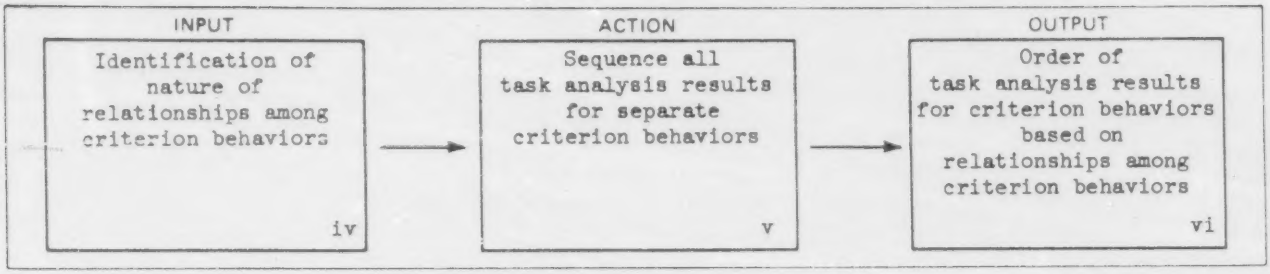
ASSESSING THE ADEQUACY OF PROCEDURES
FOR IDENTIFYING RELATIONSHIPS AMONG CRITERION BEHAVIORS

PROPERTIES	COMPLETENESS	RELEVANCE
CRITERIA	-*All relevant task analysis results (on complete sets of FORM A.5(4) or (11)) are reviewed*	-*Task analysis results are reviewed for relevant conditions:* ••*Shared elements* ••*OUTPUTS of one criterion behavior providing an INPUT to another criterion behavior* ••*Prerequisite/contingent relationship between criterion behaviors*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*FORMS for each criterion behavior sequenced before or after those of other criterion behaviors based on the relationship(s) of criterion behaviors to one another.*
WHAT YOU WILL WORK FROM	(1) The identification of relationships among all the separate criterion behaviors making up an instructional program.
WHAT YOU WILL DO	(1) Order the FORMS for the separate criterion behaviors based on their relationship(s) to one another.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	C.2.2


INPUT
Identification of nature of relationships among criterion behaviors
iv
ACTION
Sequence all task analysis results for separate criterion behaviors
v
OUTPUT
Order of task analysis results for criterion behaviors based on relationships among criterion behaviors
vi

Job Aid Contents

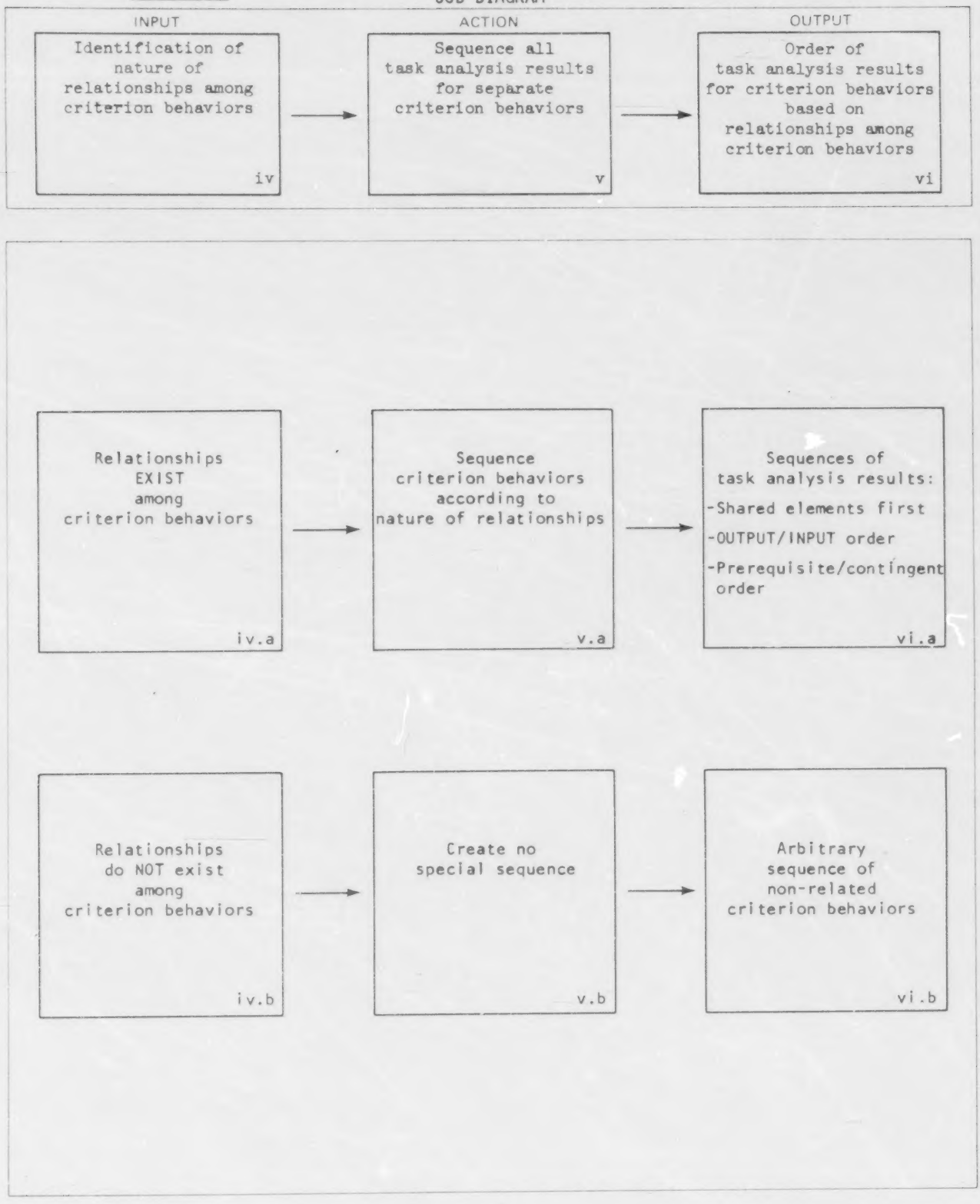
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
	-MATRIX: How to sequence separate criterion behaviors . . . 61	-MATRIX: Adequacy of sequencing of criterion behaviors . . . 63	SUMMARY OF PROCEDURES . . . 62

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
Identification of relationship among criterion behaviors	C.2.1			

Sub-STEP C.2.2

JOB DIAGRAM



JOB PROCEDURES

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SUMMARY OF PROCEDURES	62
Adequacy of procedures for sequencing separate criterion behaviors	63

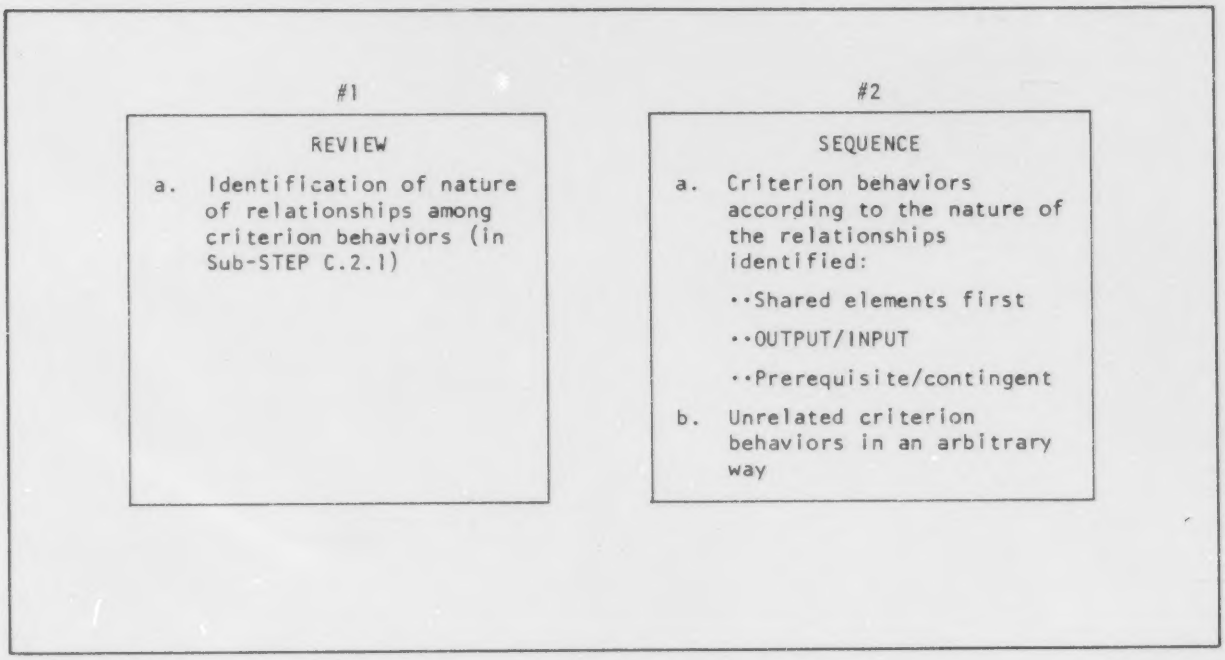
C.2.2
DECISION
MATRIX

DETERMINING HOW TO SEQUENCE (TASK ANALYSIS RESULTS FOR) SEPARATE CRITERION BEHAVIORS WITHIN A TOTAL PROGRAM

CONDITIONS	Relationships EXIST among separate criterion behaviors	Relationships do NOT exist among separate criterion behaviors
ACTION TO TAKE	*-Sequence criterion behaviors according to the nature of relationship:* *••Common elements shared by two or more criterion behaviors should be sequenced <u>ahead</u> of the criterion behaviors of which they are a part* *••Criterion behaviors whose OUTPUTS become INPUTS for other criterion behaviors should be sequenced <u>ahead</u> of the criterion behaviors to which they make INPUTS* *••Criterion behaviors which are prerequisites to other criterion behaviors should be sequenced <u>ahead</u> of the criterion behaviors which are contingent on them*	*-Sequence non-related criterion behaviors in an arbitrary way*

C.2.2

ILLUSTRATION SUMMARIZING PROCEDURES FOR SEQUENCING SEPARATE CRITERION BEHAVIORS RELATIVE TO ONE ANOTHER


#1
REVIEW
a. Identification of nature of relationships among criterion behaviors (in Sub-STEP C.2.1)
#2
SEQUENCE
a. Criterion behaviors according to the nature of the relationships identified:
••Shared elements first
••OUTPUT/INPUT
••Prerequisite/contingent
b. Unrelated criterion behaviors in an arbitrary way

C.2.2
STANDARDS
MATRIX

ASSESSING THE ADEQUACY OF PROCEDURES FOR SEQUENCING SEPARATE CRITERION BEHAVIORS

PROPERTIES	COMPLETENESS	DATA-BASED	RELEVANCE
CRITERIA	*-Sequencing decisions are made for all criterion behaviors covered by the instructional program* *··For all areas or topics (knowledge domain)* *··For all tasks or steps (performance)*	*-Sequencing decisions based on identification (in Sub-STEP C.2.1) of relationships among criterion behaviors based on a review of task analysis results on A.5(4) or (11) FORMS*	*-Sequencing decisions made are relevant to the type of relationships found among criterion behaviors*

STEP C.2

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
C.2.1	Nature of relationship among criterion behaviors			
C.2.2		Sequenced task analysis FORMS for criterion behaviors according to relationships		

STEP C.3

C.3 Create instructional units.

C.3.1 Estimate how much of a sub-criterion behavior (or a criterion behavior) can be learned in an instructional hour.*

C.3.2 Group task analysis results describing behaviors which can be taught in each instructional hour.

*There is ample opportunity following strategy formulation (TASK G) and following the actual start of the development process (TASK I) to review judgments concerning how much of a criterion behavior can be learned in an instructional hour.

STEP C.3

OVERVIEW

INPUT	ACTION	OUTPUT
Task analysis results on FORMS A.5(4) or (11) for: separate criterion behaviors for: all the sub-criterion behaviors within each criterion behavior	Block out instructional units	Groups of task analysis results for behavior to be taught in each instructional unit

C.3.1	Learning analyses on A.5(4) or (11) FORMS for a series of: ••Sub-STEPS ••terminal behaviors i	Review for levels of anticipated difficulty ii	Identification of a series of FORMS containing combinations of: High, medium, and low anticipated learning difficulty iii
C.3.2	Identification of the magnitude of learning difficulties in a series of Sub-STEPS (or terminal behaviors) iv	Group FORMS A.5(4) or (11) containing the learning analyses v	FORMS for BLOCKS of behavior (Sub-STEPS or terminal behaviors) to be taught in a succession of instructional hours vi

STEP C.3

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	CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
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C.3.2			-MATRIX: Adequacy of procedures for "GROUPING" behavior to be taught in an instructional hour 89	SUMMARY OF PROCEDURES . . . 88

BACKGROUND INFORMATION
CONCERNING ENTIRE STEP C.3

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Purposes of STEP C.3	72
What may be covered in an instructional hour	73

C.3 IDENTIFICATION MATRIX	PURPOSES OF STEP C.3	
PURPOSES	Estimating how much can be learned in an instructional hour Sub-STEP C.3.1	Grouping task analysis results by blocks of instructional hours Sub-STEP C.3.2
CRITERIA	*-The learning analyses on sequenced task analysis forms (FORM A.5(4) or (11)) are reviewed for:* *··Judged learning difficulties involved* *-Based on the review, an estimate is made of how much students can learn in an instructional hour*	*-The task analysis results for all criterion behaviors in the program are blocked into groups:* *··What it is judged can be learned in a succession of instructional hours*

C.3

IDENTIFICATION MATRIX

LIKELY AMOUNTS OF "BEHAVIOR" WHICH STUDENTS CAN LEARN IN AN INSTRUCTIONAL HOUR*

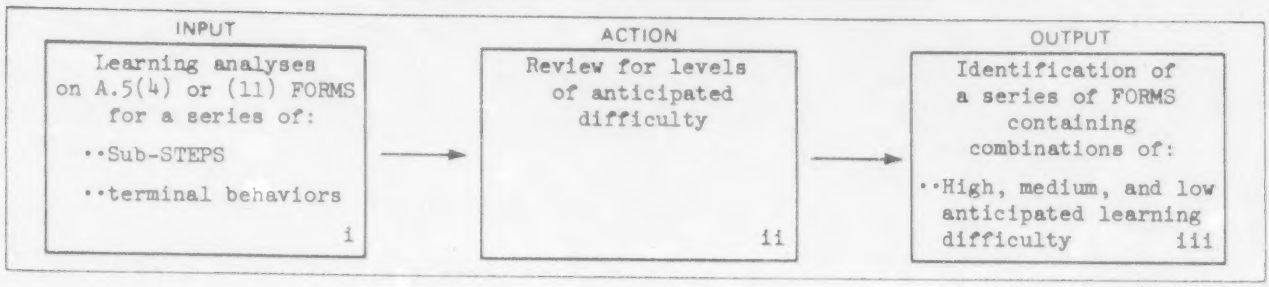
AMOUNTS	LESS than a Sub-Criterion behavior	ONE Sub-Criterion behavior	TWO OR MORE Sub-Criterion behaviors (part of the same criterion behavior)	A WHOLE criterion behavior	TWO OR MORE criterion behaviors
CRITERIA	*-It may require an entire instructional hour to teach:* *••One or more Sub-STEPS (or terminal behaviors) making up a Sub-Criterion behavior* *••Component skills which underlie a Sub-STEP (or a terminal behavior)*	*-It may require an entire instructional hour to teach:* *••Just one Sub-Criterion behavior (out of two or more which make up a criterion behavior)*	*-It may require an entire instructional hour to teach:* *••Two or more Sub-Criterion behaviors (but less than all the Sub-Criterion behaviors) which make up a criterion behavior*	*-It is possible within one instructional hour to cover:* *••A single criterion behavior*	*-It is possible within one instructional hour to cover:* *••Two or more separate criterion behaviors (sequenced purposefully or randomly)*

*Any given instructional program is likely to be made up of instructional hours varying in how much is covered; within the same program some instructional hours may be adequate to cover two or more CRITERION behaviors, at one extreme, while other instructional hours may be devoted only to component skills for a single Sub-Criterion behavior

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*An identification of the degree of difficulty learners can be expected to experience in learning the behaviors described in a series of FORMS.*
WHAT YOU WILL WORK FROM	(1) A series of FORMS (sequenced earlier) summarizing learning analysis results.
WHAT YOU WILL DO	(1) Identify the anticipated difficulty learners will experience in learning the behaviors described in the same series of FORMS.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	C.3.1



Job Aid Contents

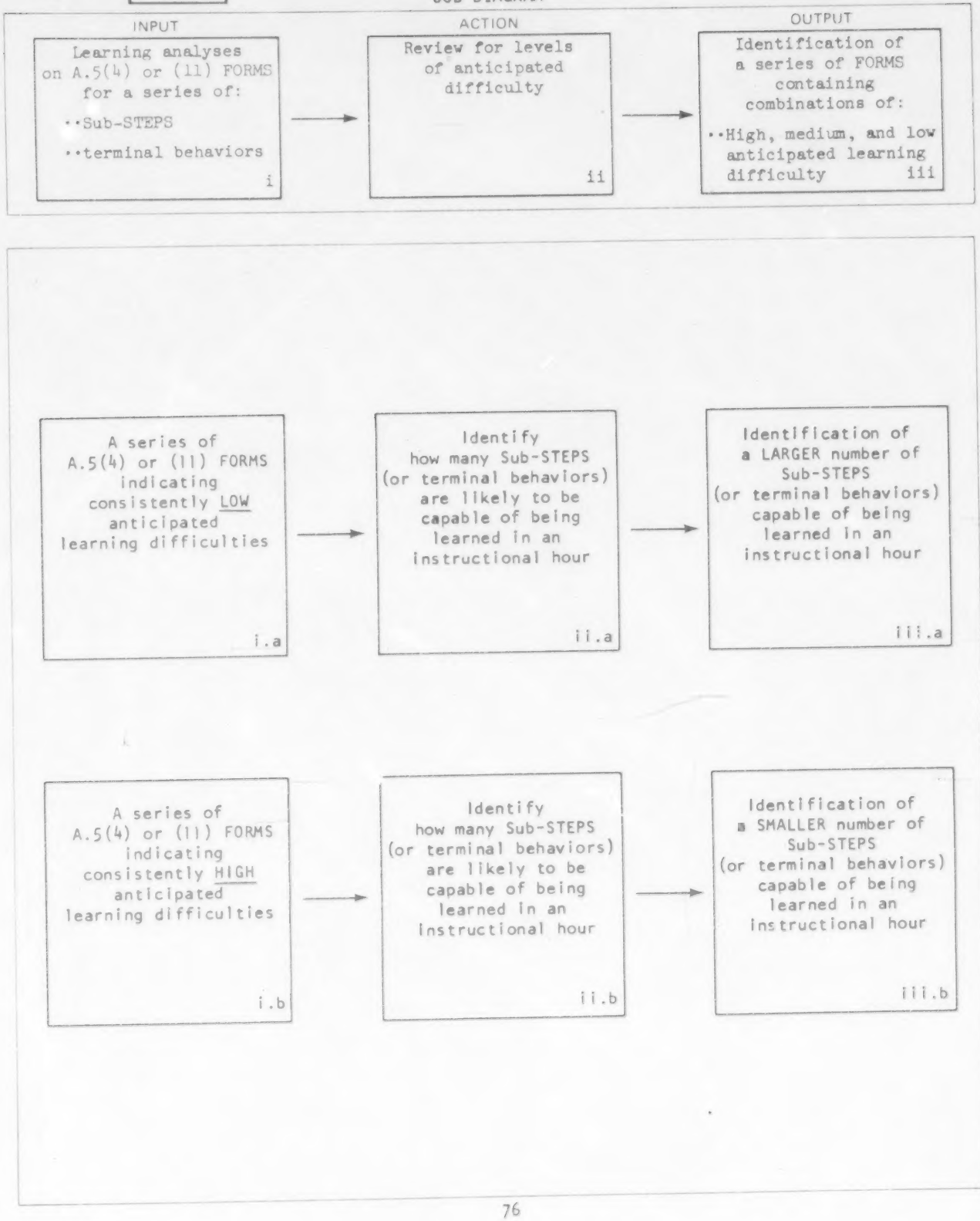
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
-MATRIX: Learning analyses as basis for judgments about how much can be learned in an instructional hour 78	-MATRIX: Determining how much can be learned in an instructional hour 79	-MATRIX: Adequacy of estimate of amount to be learned in an instructional hour 83	SUMMARY OF PROCEDURES . . . 82

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		Task analysis forms FORMS A.5(4) or (11) carried forward from	C.2.2	

Sub-STEP C.3.1

JOB DIAGRAM


INPUT
Learning analyses on A.5(4) or (11) FORMS for a series of:
••Sub-STEPS
••terminal behaviors
i
ACTION
Review for levels of anticipated difficulty
ii
OUTPUT
Identification of a series of FORMS containing combinations of:
••High, medium, and low anticipated learning difficulty
iii
A series of A.5(4) or (11) FORMS indicating consistently LOW anticipated learning difficulties
i.a
Identify how many Sub-STEPS (or terminal behaviors) are likely to be capable of being learned in an instructional hour
ii.a
Identification of a LARGER number of Sub-STEPS (or terminal behaviors) capable of being learned in an instructional hour
iii.a
A series of A.5(4) or (11) FORMS indicating consistently HIGH anticipated learning difficulties
i.b
Identify how many Sub-STEPS (or terminal behaviors) are likely to be capable of being learned in an instructional hour
ii.b
Identification of a SMALLER number of Sub-STEPS (or terminal behaviors) capable of being learned in an instructional hour
iii.b

BACKGROUND INFORMATION

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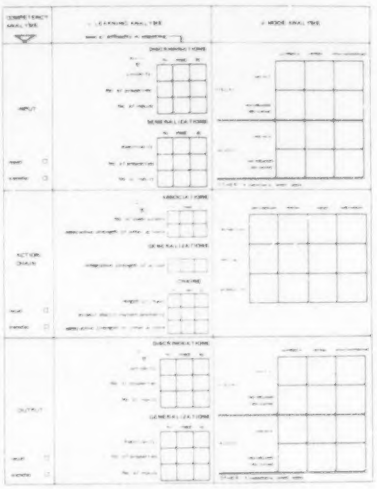
Information to review in determining the amount of "behavior" which students can learn in an instructional hour	78
Determining how much behavior can be learned in an instructional hour	79

C.3.1

IDENTIFICATION MATRIX

INFORMATION TO REVIEW IN DETERMINING HOW MUCH "BEHAVIOR" STUDENTS ARE LIKELY TO BE ABLE TO LEARN IN AN INSTRUCTIONAL HOUR

TYPE OF BEHAVIOR	PERFORMANCE	KNOWLEDGE DOMAIN
CRITERIA	*-A sequenced set of A.5(4) FORMS containing a LEARNING ANALYSIS:* *··One FORM for each Sub-STEP (or for a Sub-Sub-STEP)* *··A series of such FORMS for all Sub-STEPS which make up each Sub-Criterion behavior* *··A set of FORMS for all Sub-Criterion behaviors which make up a criterion behavior* *··Multiple sets of FORMS for all criterion behaviors*	*-A sequenced set of A.5(4) FORMS containing a LEARNING ANALYSIS:* *··One FORM for each terminal behavior* *··A series of such FORMS for all terminal behaviors which make up each Sub-Criterion behavior* *··A set of FORMS for all terminal behaviors which make up a criterion behavior* *··Multiple sets of FORMS for all terminal behaviors*
		

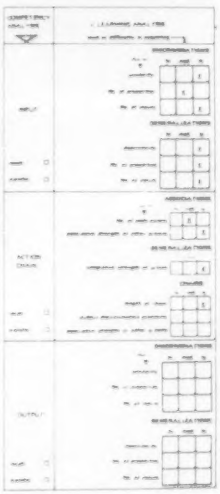
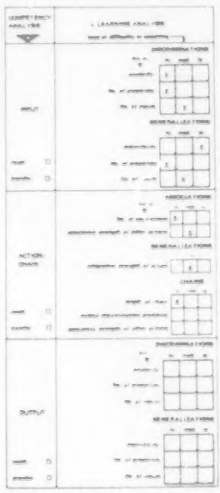
C.3.1

DECISION MATRIX

JUDGING HOW MUCH BEHAVIOR CAN BE LEARNED DURING AN INSTRUCTIONAL HOUR: BASED ON IDENTIFIED LEARNING DIFFICULTIES*

CONDITIONS	A series of separate LEARNING ANALYSES revealing consistently LOW anticipated learning difficulties	A series of separate LEARNING ANALYSES revealing consistently HIGH anticipated learning difficulties
ACTION TO TAKE	*-Identify a larger number of separate Sub-STEPS (or terminal behaviors) as being capable of being learned in an instructional hour*	*-Identify a smaller number of separate Sub-STEPS (or terminal behaviors) as being capable of being learned in an instructional hour*

*Although judgments of this type are based on data (i.e., learning analyses), experience in performing this Sub-STEP is probably the surest guide as to precisely how much can be learned in an instructional hour

EXAMPLE (just one diagram, not a series)		

JOB PROCEDURES

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Adequacy of procedures for estimating how much can be learned in an instructional hour	83

C.3.1

ILLUSTRATION SUMMARIZING PROCEDURES FOR ESTIMATING HOW MUCH CAN BE LEARNED IN AN INSTRUCTIONAL HOUR

#1

a. REVIEW the learning analysis results on the sequenced series of A.5(4) or (11) FORMS

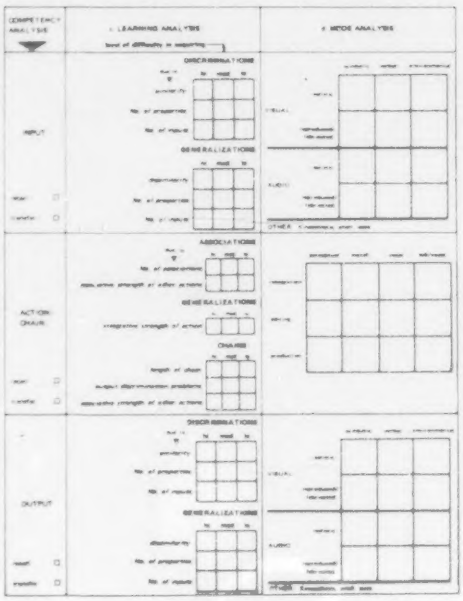
b. Identify where the series contains learning analyses which reveal:

  ••Consistently difficult learning throughout the series

  or

  ••Consistently easy learning throughout the series

Right-hand Side of FORM A.5(4)



C.3.1
STANDARDS
MATRIX

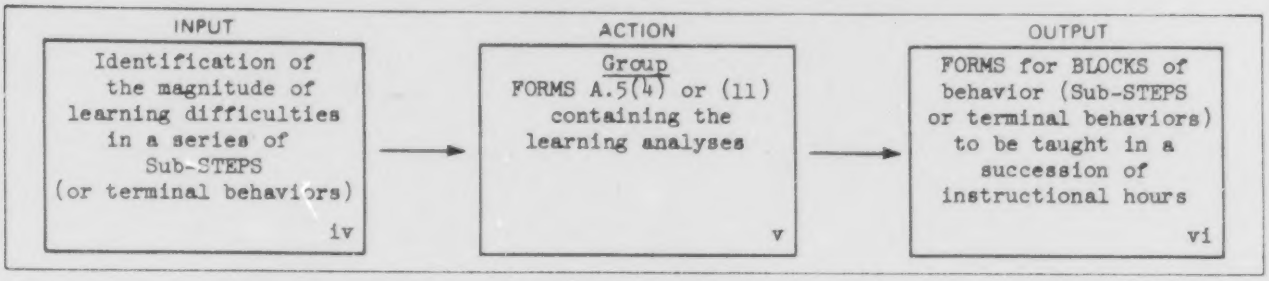
ASSESSING THE ADEQUACY OF PROCEDURES FOR ESTIMATING HOW MUCH CAN BE LEARNED DURING AN INSTRUCTIONAL HOUR

PROPERTIES	DATA-BASED	COMPLETENESS
CRITERIA	*-Estimation is based on learning analyses revealing the magnitude (high, medium, low) of the difficulty in learning component skills involved in each Sub-STEP (or in each terminal behavior)*	*-Review of learning analyses is performed for all Sub-STEPS (starting at the beginning)* *-Identification of how much can be learned in an instructional hour is based on:* *••The magnitude of learning difficulties for each Sub-STEP (or terminal behavior)* *••The consistency of learning analyses for a series of Sub-STEPS (or terminal behaviors)*

PREVIEW OF THE NEXT SubSTEP

YOUR PRODUCT	*Grouped FORMS describing the behavior to be taught each instructional hour (the amount of behavior to be taught depending on anticipated learning difficulty).*
WHAT YOU WILL WORK FROM	(1) The identification of the degree of anticipated difficulty in learning the behavior described in a series of FORMS.
WHAT YOU WILL DO	(1) Group these FORMS describing the behavior which, because of estimated difficulty learning them, can be learned in an instructional hour. (2) Repeat until all FORMS are grouped and create the total number of instructional hours to be prepared.
FORMS YOU WILL USE	None

DESCRIPTION OF Sub-STEP	C.3.2


INPUT
Identification of the magnitude of learning difficulties in a series of Sub-STEPS (or terminal behaviors)
iv
ACTION
Group FORMS A.5(4) or (11) containing the learning analyses
v
OUTPUT
FORMS for BLOCKS of behavior (Sub-STEPS or terminal behaviors) to be taught in a succession of instructional hours
vi

Job Aid Contents

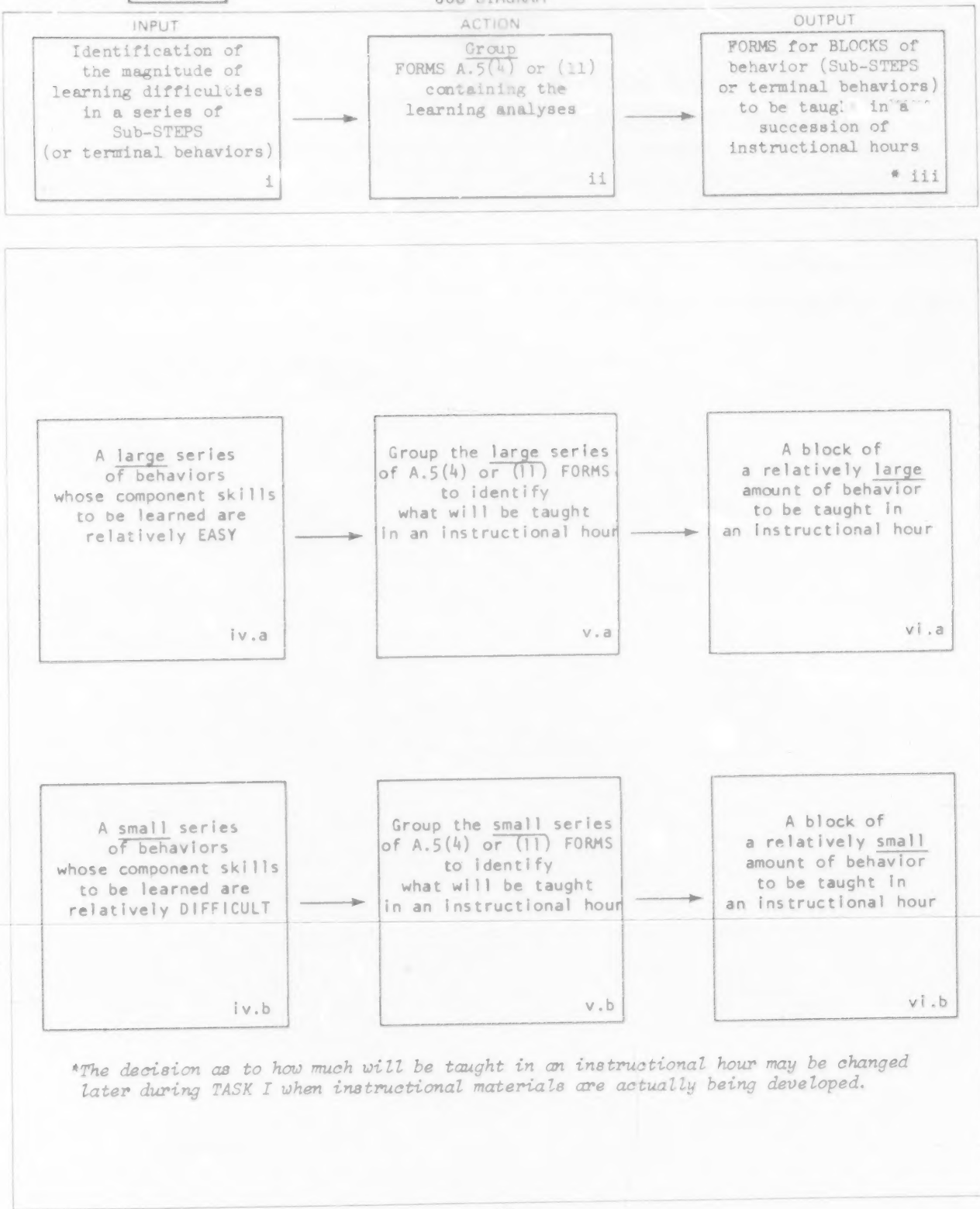
CRITERIA FOR IDENTIFYING INPUTS	ACTION TO BE TAKEN	STANDARD FOR OUTPUTS	FORMS TO USE
		-MATRIX: Adequacy of procedures for "GROUPING" behavior to be taught in an instructional hour 89	SUMMARY OF PROCEDURES . . . 88

Required Materials

COMPLETED MATERIALS	STEP	COMPLETED FORMS	STEP	BLANK FORMS
		A.5(4) or (11) FORMS carried forward from	C.3.1	

Sub-STEP C.3.2

JOB DIAGRAM


INPUT
ACTION
OUTPUT
Identification of the magnitude of learning difficulties in a series of Sub-STEPS (or terminal behaviors)
i
Group FORMS A.5(4) or (11) containing the learning analyses
ii
FORMS for BLOCKS of behavior (Sub-STEPS or terminal behaviors) to be taught in a succession of instructional hours
* iii
A large series of behaviors whose component skills to be learned are relatively EASY
iv.a
Group the large series of A.5(4) or (11) FORMS to identify what will be taught in an instructional hour
v.a
A block of a relatively large amount of behavior to be taught in an instructional hour
vi.a
A small series of behaviors whose component skills to be learned are relatively DIFFICULT
iv.b
Group the small series of A.5(4) or (11) FORMS to identify what will be taught in an instructional hour
v.b
A block of a relatively small amount of behavior to be taught in an instructional hour
vi.b

The decision as to how much will be taught in an instructional hour may be changed later during TASK I when instructional materials are actually being developed.

JOB PROCEDURES

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Adequacy of procedures for "GROUPING" behaviors to be learned in an instructional unit	89

C.3.2

ILLUSTRATION SUMMARIZING PROCEDURES FOR CREATING BLOCKS OF BEHAVIOR TO BE TAUGHT IN AN INSTRUCTIONAL HOUR

#1

a. Review the identification (made in Sub-STEP C.3.1) of the patterns of anticipated learning difficulties for a series of Sub-STEPS (or terminal behaviors):

  ··A larger series of easily learned behaviors

  ··A smaller series of behaviors which are difficult to learn

#2

a. GROUP blocks of behavior (to form instructional units of an hour's duration) according to anticipated learning difficulties:

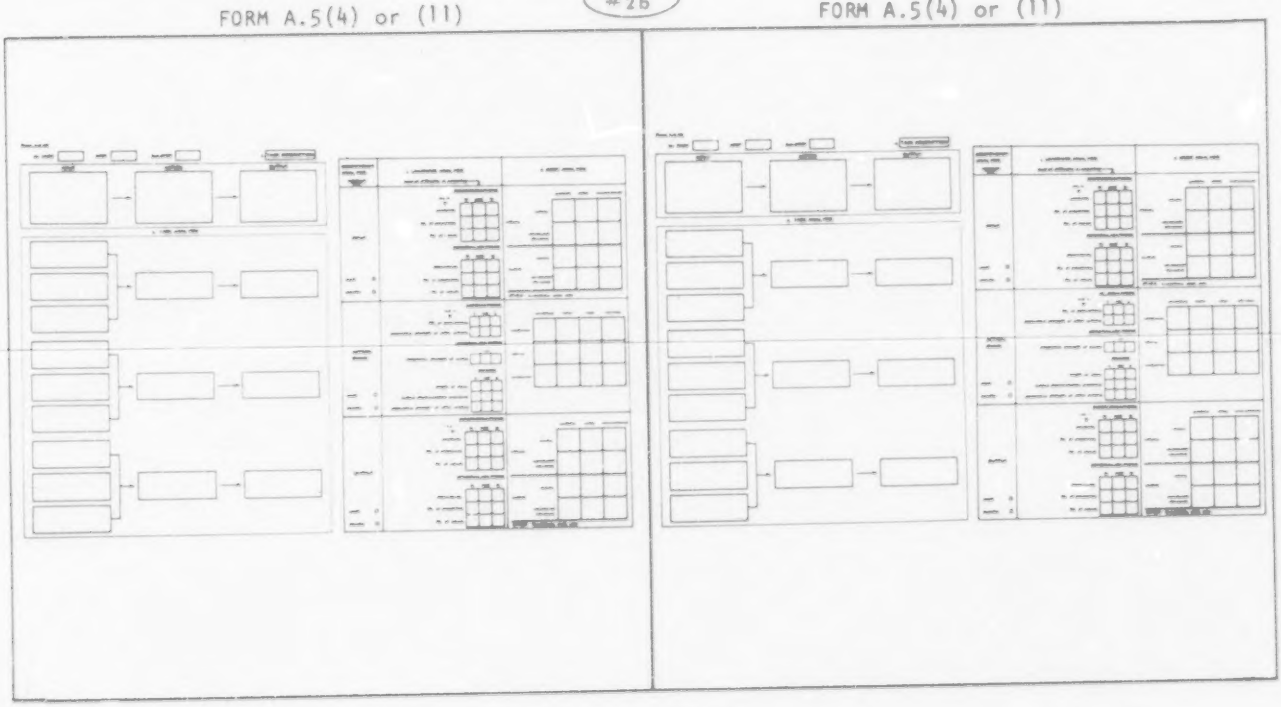
  ··A bigger block of easily learned behaviors

  ··A smaller block of harder to learn behaviors

b. End up with sets of A.5(4) or (11) FORMS grouped together for each and every instructional hour in the total program.*

**The illustration below for one instructional hour shows two FORMS grouped together. The possibilities are from one to two or more (depending on the learning difficulties involved)*

FORM A.5(4) or (11) #2b FORM A.5(4) or (11)



C.3.2
STANDARDS
MATRIX

ASSESSING THE ADEQUACY OF PROCEDURES FOR GROUPING BEHAVIORS TO BE TAUGHT IN AN INSTRUCTIONAL HOUR

PROPERTIES	RELEVANCE	COMPLETENESS
CRITERIA	-*Creation of BLOCKS of behavior are based on anticipated difficulties students will have in learning the component skills involved in each Sub-STEP or terminal behavior:* ··*The lower the anticipated difficulty, the more Sub-STEPS (or terminal behaviors) will be blocked together into an instructional hour* ··*The higher the anticipated difficulty, the fewer Sub-STEPS (or terminal behaviors) will be blocked together into an instructional hour*	-*The entire instructional program is represented by a succession of BLOCKS of behavior* -*Each block of behavior is represented by a set of A.5(4) or (11) FORMS*

STEP C.3

COMPLETION CHECKLIST

	IDENTIFIED	PERFORMED	PRODUCED	FORMS COMPLETED
C.3.1	The extent of learning difficulties for a series of behaviors			
C.3.2		Grouped blocks of behavior to be taught in separate instructional hours		